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The Distribution Scheme

A MILD sensation has been caused in electrical circles during the past week or so by statements that have appeared in the daily papers regarding "Government proposals" for the reorganisation of distribution. These statements, varying as to the details given and in the emphasis laid upon different aspects, are, of course, efforts to summarise the contents of a confidential memorandum addressed by the Ministry of Transport to representative bodies in the electrical industry for their constructive criticism.

The purpose of the memorandum being to provide a basis for discussion among those whose experience of electricity supply practice would be most helpful in giving legislative effect later on to the recommendations of the McGowan Report, it would seem that the interest of the public at this stage is only that aroused by the "leakage of a State secret."

Presumably the policy of secrecy was adopted in the desire to avoid a chance of tentative views being mistaken for definite intentions, but it seems to have had the opposite effect. The Press has not been taken into the confidence of the Ministry, and so we have been afforded no opportunity of studying the document. As the Ministry has refused us a copy we are able only to present, as a matter of topical news interest for the information of our readers, the main features that are common to the various accounts in circulation.

Modifications in the recommendations of the McGowan Report were to be anticipated. It is not surprising, for instance, that no reference is made to the sale of ten million kWh per annum as a suitable dividing line whereby to separate the sheep from the goats, or that the difficulty of securing men of requisite standing to serve for a short term as District Commissioners has been got over by making the Electricity Commissioners responsible for drawing up the schemes for co-ordinating the work of distribution authorities.

More unexpected, probably, is the small number of groups into which it is suggested that distributors should be amalgamated. The figure of seventy-six mentioned is less than one-eighth of the total number of undertakings now in existence, and is roughly equivalent to those selling more than fifty million kWh per annum each, the aggregate output of which is nearly three-quarters of that of the country as a whole.

Three types of organisation are under consideration. The first provides for the amalgamation of companies, which are to be transferred to a public body within a maximum period of fifty years. The second type is envisaged as a joint board formed by contiguous municipal systems; there are existing precedents for this form of operation. One undertaking might have a "scheme" to itself.

The third type of controlling body is more of a novelty. It would resemble the Central Electricity Board in certain respects and would be composed of not more than twelve men to be appointed by the Minister of Transport, and would take over both municipally and company-owned undertakings—presumably those that could not be fitted into mergers of the other two kinds. The right of appeal by undertakings to Parliament seems to have been safeguarded.

Two points at least of those put forward seem likely to meet with general approval. One is that prices to consumers shall not be arbitrarily raised; the other is that compensation will be paid to officials whose position is worsened as a result of any rearrangement.

Such are apparently the main proposals that have been put before the electricity supply industry for comment. We gather that the Press accounts have not been clear to many of our readers, and in many cases their incompleteness has led to some ambiguities. One cause of this is, we believe, that the memorandum was loosely worded to allow details to be filled in as a result of the suggestions that will, no doubt, be made by those having first-hand experience of the difficulties to be overcome.

In any case, whether accurately reported or no, the present proposals must not be treated as the last word. They will, without doubt, be considerably modified before they take anything like final shape as a generally accepted scheme for submission to Parliament

Welsh Farmers' Need

A PLEA for a more vigorous electricity supply policy in rural Wales was made in the course of a broadcast last week in the B.B.C. West and Wales programme by Mr. H. James, a member of the Council of Agriculture for Wales, and Mr. W. H. Jones, a Caernarvonshire farmer. Connection to the supply network of more than 500 farms in sparsely populated Dumfries-shire since 1931 (in the area of the County Council Electricity Department, to which Mr. J. S. Pickles is engineer) was quoted as an example of what could be done. Welsh countrypeople as a whole, it was claimed, realised what a boon electricity could be on the farm, in the dairy and in the farmhouse. Many were told that supply projects were uneconomic. Generally, there was a charge for the step-down transformer and also for low-voltage lines over a certain length. It was mentioned that those farmers who could afford to do so had installed their own generating plant. This eagerness to "go electric" may quite possibly be a serious deterrent to the extension of the public supply by excluding valuable loads from such schemes. Nevertheless, it cannot be gainsaid that the rural areas must assume an increasingly important place in electrical development. An interesting book on the subject, "Electrification of Agriculture and Rural Districts," by E. W. Golding, has recently been published by the English Universities Press, the author being lecturer in electrical engineering at University College, Nottingham.

Refrigeration

THE National Refrigeration Campaign organised by the British Electrical Development Association commenced in March and is now in full swing. Throughout the London and provincial Press advertisements have been appearing at regular intervals stressing the value of *electrical* refrigeration, which possesses many advantages over other methods. As a means of sustaining and increasing interest, a series of luncheons is to be held in June during the "Refrigeration Fortnight" which is the "high spot" of the Campaign. At these functions the improved health aspect of refrigeration is being particularly stressed and the support of eminent health authorities is anticipated. The London luncheon is being held at Grosvenor House on June 10th, and E.D.A. appeals for the enthusiastic co-operation of the industry to make this and the provincial functions a means of establishing the supremacy of the electric method of refrigeration.

Film Propaganda

ONE of the most potent forms of propaganda is the cinema, and it is a method that the electrical industry has not yet fully exploited. There are several concerns nowadays which are able to produce short "documentary" films at a reasonable cost, and it is a matter which even individual undertakings will find worthy of consideration. Past efforts have included the E.D.A. films, which have proved very popular for a long period and must have done a great deal of good. Last year, too, E.D.A. co-operated with the Southern Railway in the production of a travel film in which electrification received some attention. Again, a number of manufacturing companies have had short films made illustrating their activities in an attractive way, to say nothing of the general interest of the "Face of Britain" film shown a year or two ago. The latest cinematographic effort is that of the Ilford Electricity Department mentioned in our "Business Notes." This, in a short time and effective manner, introduces a number of electrical applications, and it should result in the sale of more units.

Good Deeds

OUR attention has been drawn to the fact that Mr. Frank Parkinson's offer to add 10 per cent. to the amount received by the Electrical Industries Benevolent Association during 1937 extends to the whole of the payments under deeds of covenant. This means that the 10 per cent. is not applied merely to the 1937 payments under such deeds but to the total amount payable during the life of the agreement. The peculiar advantage of this form of donation is that the Association can recover the income tax paid, which cannot be done in the case of an annual subscription. It is suggested, therefore, that the generous giver should adopt this method of subscription and thus secure for the Association the maximum benefit.

Electric Discharges

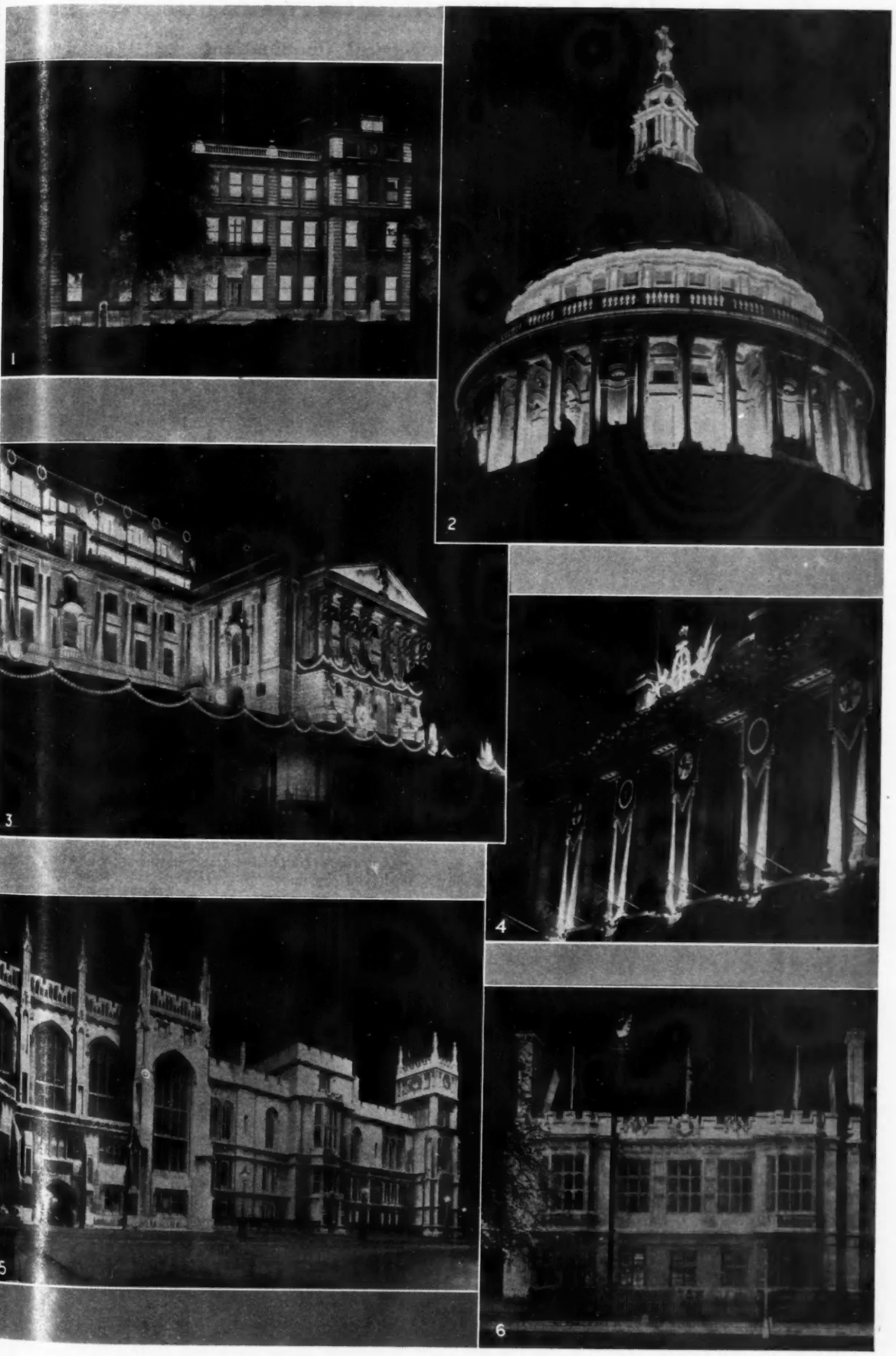
MANIFESTATIONS of the effects of static electricity are not uncommon in certain industrial processes, and research is being carried out at the National Physical Laboratory as to circumstances in which they may cause explosions or fires in dry-cleaning establishments. Lately in our "Correspondence" section readers have given their experiences of what is essentially the release of an electric strain set up by condenser action by which charges of different polarity appear on opposite sides of a dielectric. These have been harmless, but now comes the suggestion that the wrecking of the *Hindenburg* was due to the ignition of hydrogen by a spark when its hull, which was charged to a high potential (possibly by travelling at speed under unfavourable atmospheric conditions), approached the mooring mast. Expert opinion is not unanimous on this point, but the possibility of its providing the correct explanation cannot be ruled out at this stage. Any investigations into the conditions under which an electrostatic charge may be dangerous should not, however, include in its terms of reference a mention of the use of "man-made" electricity, as it is undesirable that consumers should be confused by associating one form of electricity with another.

Heat in Industry

ALTHOUGH the consumption of electricity (from all sources) in Switzerland increased by nearly 5 per cent. last year, the kWh sold for domestic purposes was almost stationary, while motive power showed a decline. The over-all advance is attributed to the industrial and commercial heating load, which took about 1,390 million kWh out of a total of 4,600 million kWh sold, thus overtaking the domestic consumption and using double the amount required for motive power. For electro-chemical and metallurgical uses an advance is recorded of from 778 to 885 million kWh, but the brightest feature was an increase of 64 per cent. in energy consumed by electric boilers and hot water accumulators, which reached 501 million kWh. The low running charges associated with water-power are, no doubt, favourable to the development of this class of load, but the advantage is not so great as is commonly supposed. In Great Britain the industrial heating load is only about one-tenth of the power load, but developments in some areas appear to indicate that equality can reasonably be aimed at.

Day-time Instruction

THERE has been a marked increase during the last six years in the number of students under the National Certificate scheme who have been released from their practical work during the day in order to attend approved courses at technical colleges. The President of the Board of Education (Mr. Oliver Stanley) has expressed his entire agreement with the endeavour of the Council of the Institution of Electrical Engineers to extend this form of co-operation between industry and education into districts where the requisite facilities are not yet given. Its advantages include a doubling of the hours of study and the possibility of planning courses of wider educational value. These of themselves should be of ultimate value to employers, apart from the benefit to the health of their apprentices in easing the strain of crowding their studies into the evening after a hard day's work. Continuous periods of a few days at college would, we believe, be less likely to interfere with work in the shops than a day or half-day at intervals, but, in any case, the scheme is well worth adoption.



London Buildings Decorated with Light for the Coronation

1. Marlborough House. 2. St. Paul's Cathedral. 3. The Bank of England. 4. Floodlighted flags and banners at Australia House. 5. The Inner Temple. 6. Incorporated Accountants' Hall, Victoria Embankment. (Nos. 1, 4 and 6 are ELECTRICAL REVIEW photographs)

The Coronation Festivities

Further notes on the electrical illuminations

THE use of decorative lighting for the Coronation celebrations has proved even more widespread than at first anticipated, and even the smallest villages can boast some form of illuminations even if they take the form of only a little strip-lighting. Generally, however, the schemes are of an elaborate character and we are reproducing in this issue a further selection of photographs of outstanding installations, together with additional details that have come to hand since last week.

In London, Marlborough House, the home of Queen Mary, is now to be seen floodlighted for the first time. Siemens equipment is used for this, as well as for a number of other buildings illustrated in this issue, such as the amber-coloured

The Royal Naval College, Greenwich

St. James's Palace, Australia House with its effective illuminated banners and the Incorporated Accountants' Hall. The joint Siemens and G.E.C. effort at St. Paul's Cathedral is a conspicuous sight from all over central London.

Attractive combinations of floodlighting and illuminated devices have been produced at the Bank of England (electrical contractors: Drake & Gorham, Ltd.) and at the headquarters of the Prudential Assurance Co., Ltd., employing apparatus supplied by the G.E.C., who were also responsible for the equipment at Windsor Castle, the Inner Temple and Bond Street (electrical contractors: District Electric, Ltd.).

Eighty-three projectors of various types, totalling 50 kW, were utilised by Electrical Installations, Ltd., for the illumination of the headquarters of Cable & Wireless, Ltd., at Electra House, Victoria Embankment. They were supplied by Davis Bros., Illuminating Engineers, Ltd., and the Edison Swan Electric Co., Ltd., the latter company also being responsible for the National Gallery installation.

Referring to the floodlighting at the University College, Gower Street, a picture of which appeared in our last issue, the Simplex Electric Co., Ltd., claims that the wide-angle floodlight projectors fitted with vitreous-enamel reflectors and clear fronts have a greater efficiency than those fitted with diffused fronts. The resulting illumination is remarkably even over the entire front of the building. The dome is illuminated by a battery of narrow-angle projectors fixed behind the canopy.

The two electric beacons on Shell-Mex House are among the most popular London novelties. They are constructed of painted canvas and each is lighted by twelve 1,000-W red and amber lamps, four of which are arranged to give a flickering effect. Steam released from the top produces realistic "flame" reaching up to a height of 32 ft. The work for this scheme, together with colour-changing equipment for illuminating the 30-ft. jets from the fire floats on the Thames outside the new Fire Brigade Headquarters, was carried out by the Strand Electric Co., Ltd.

Some idea of the magnitude of the floodlighting scheme at the Royal Naval College, Greenwich, can be gained from the fact that the photograph reproduced was taken from the gardens on the opposite side of the Thames. In the rear will be seen the "Queen's House," once the home of the wife of Charles I, and now the National Maritime Museum recently opened by the King. "Cosmos" lamps and equipment are used throughout the installation.

From the provinces Mr. W. K. Fleming, borough electrical engineer and manager of Scarborough, sends us some interesting photographs of installations in his town, including the Town Hall (red "Osira"), the Castle, Peasholm Bridge and the Lighthouse. At Worcester the riverside is providing the greatest attraction in the evenings. Mr. C. M. Shaw, the city electrical engineer, tells us that for a mile or so each bank, as well as the bridges, are being lighted with coloured lights and fountains, illuminated boat processions also being arranged. Elsewhere in the city the Cathedral, St. Andrew's Church and the Guildhall are the principal buildings illuminated, coloured strip lighting being provided in Cripplegate Park. For the installation at the Town Hall, Newport, Mon., the decoration lamps were supplied by Ensign Lamps, Ltd.

At Glasgow illuminated trams have been built to resemble models of the liner *Queen Mary*, and also the *Comet*, the first steamship to sail on the Clyde. Two other trams illustrate the evolution of housing. The head offices of the Transport Department are being illuminated with special lighting apparatus, which throws a searchlight over a large area of the city

Left: Prudential Assurance Co.'s headquarters. Centre: Peasholm Bridge, Scarborough. Right: Town Hall, Newport (Mon)

The Romance of the Power Companies.—IV

Past and Future

By J. M. Donaldson, M.Inst.C.E., M.I.E.E.

IT falls to my lot as President for the time being of the Incorporated Association of Electric Power Companies to round off, as it were, the series of contributions which has been appearing in the ELECTRICAL REVIEW under the above heading.

Sir James Devonshire's article in the issue of March 26th shows how the Power Companies came to be born and a very romantic story it is. It should be understood that a Power Company is ordinarily defined as a company incorporated by its own Act of Parliament with powers of supply in perpetuity, such as the General Power Distributing Company had conferred upon it when it left the House of Lords in 1899. This indeed is the essence of the business, since, with highly speculative undertakings such as these were in the early days, freedom from individual purchase by local authorities was absolutely essential if work were to be carried out on a large scale and capital attracted for that purpose. In passing it may be added that practically all the gas and water companies in this country have perpetual powers.

Capt. J. M. Donaldson is chief engineer of the North Metropolitan Electric Power Supply Co. and president of the Incorporated Association of Electric Power Companies

In addition to the true Power Company as defined above, there have arisen undertakings carrying out very similar functions, *i.e.*, in scattered areas of large extent where special powers have been given by Parliament for fifty years and in many cases the condition has been made that such an area shall be purchased as a whole by one authority, thus anticipating the general tenor of the McGowan Report referred to later.

When the areas covered by the various Power Companies are put on a map of England the result is very impressive, but it is also somewhat misleading because a map of this sort cannot very well indicate the fact that all the cities and practically all the large towns are independently supplied by their own municipal authorities and that, owing to what is known as the "Kitson Clause," the Power Company cannot supply in these areas without the consent of the municipality. The presence of these large aggregations of population, therefore, is of no advantage to the Power Company except in so far as such urban centres may throw out suburban growths outside their own municipal confines, while there is a positive disadvantage in that it is generally necessary to go round rather than through these urban areas when laying down a system of mains.

The very important report made by the Ministry of Reconstruction, Coal Conservation Committee, and presented to Parliament in 1918, made the following reference, among others, to the position of the Power Companies:—

"The more one considers the matter and examines the facts the more clear does it become that the so-called Power Act legislation was faulty in certain important respects. Parliament was apparently convinced that the generation and supply of electricity must be dealt with in a big way, though how important this would become they perhaps hardly foresaw. They were, however, apparently afraid to insist on the amalgamation of the existing lighting enterprises which, as has been shown, were and are still each limited to a few miles of area instead of covering, as they should, a few counties. Parliament, therefore, devised the existing form of Power Acts which is complicated and unworkable. The special clauses these Acts contain were accepted by the existing lighting authorities because they thought they would have the effect of keeping out the Power Companies, while the Power Companies in accepting them hoped they would have the effect of bringing in the lighting authorities as their customers. In the result the electric lighting authorities in the majority of important districts have, from their point of view, succeeded in practically stopping the growth of the power companies, except in one or two cases."

It will be found that there is no specific legislation on the Statute Book dealing with Power Companies as a whole but that in point of fact each of the Power Companies obtained a special Act very much on the same lines as those laid down by Lord Cross's Committee. These Power Company Acts are, in my opinion, the most fruitful pieces of legislation dealing with electricity supply and they have laid the foundation for a general supply over the whole country. In saying this I do not except either the Act of 1919 or the Act of 1926. The former established the Electricity Commissioners and also made it possible to run overhead lines, which lines formerly could have been vetoed by any local authority. Furthermore, an attempt was made to unify the supply of the country, but these proposals were emasculated in the Bill's passage through the House and in this respect the Act became permissive only. The Act of 1926, which established the Central Electricity Board, was, of course, one of the greatest importance, but it might be pointed out that, had it not been for the far-flung enterprises of the Power Companies, such an Act could hardly have taken its present form.

Moreover, it must be said that nearly all the Power Companies had two or more power stations which, in many instances, were separated by considerable distances and these were usually interconnected and run in parallel. The experience so obtained has been of vital consequence in the operation of the grid since this consists in the main of running similar large power stations separated by considerable distances and connected sometimes by overhead lines and sometimes by underground mains.

The most important feature of Power Company legislation was, as I have said, the perpetual powers given, but Lord Cross's Committee were fully seized of the fact that, in order to supply power in bulk cheaply, it was necessary to have (1) an efficient power station or power stations of large size and (2) a large and diversified area. Therefore the Power Companies had to turn their attention to generating on as large a scale and as efficiently as possible and to develop economical methods of transmission over long distances in order to gather in the load.

Mr. Taite's article in the issue of April 30th brings out very clearly the advance which has been made in the size and efficiency of power stations and it will easily be recognised how vital a part this played in the case of those concerns

STATIONS GENERATING OVER 300 MILLION UNITS PER ANNUM.

	WHOLE UNDERTAKINGS.				BEST GENERATING STATION IN UNDERTAKING.				
		GROUP OF STATIONS.							
	Names of Station Owners.	No. of Stations in Group.	Total Units Generated Millions.	Average Fuel per Unit lb.	Name of Station.	Total Units Generated Millions.	Average Fuel per Unit lb.	Thermal Efficiency (approx.).	Maximum Load on Generators kW.
1.	London Power Company	6	1,925.3	1.22	Battersea	797.7	0.96	28.59	133,650
2.	County of London E.S. Co. ...	3	1,650.1	1.34	Barking B.	875.7	1.09	28.07	150,000
3.	North Eastern E.S. Co., Ltd. ...	12	1,011.9	1.37	Dunston B.	406.2	1.11	27.25	117,600
4.	Birmingham Corporation	4	778.6	1.70	Hams Hall	452.8	1.34	23.41	131,400
5.	Manchester Corporation	3	747.2	1.42	Barton	632.4	1.29	22.10	123,990
6.	Liverpool Corporation	3	567.4	1.24/1.26	Clarence Dock	386.3	1.12	26.21	67,620
7.	Lancashire Elec. Power Co. ...	3	506.2	1.25	Kearsley	401.9	1.17	23.95	60,800
8.	Yorkshire Electric Power Co. ...	4	480.6	1.38/1.32	Thornhill	217.9	1.36	21.77	57,750
9.	West Midlands J.E.A.	4	404.4	1.62	Ironbridge	310.4	1.42	25.59	52,900
10.	North Metropolitan E.P.S. Co. ...	3	398.4	1.45	Brimsdown "B"	346.2	1.42	22.89	114,000
11.	Glasgow Corporation	1	392.7	1.67	Dalmarnock	392.7	1.67	18.66	128,000
12.	Derby & Notts E.P. Co.	1	362.4	1.37	Spondon	362.4	1.37	23.97	69,200
13.	Leeds Corporation	2	337.5	1.60	Kirkstall	231.9	1.35	22.63	46,200
14.	Clyde Valley E.P. Co.	2	334.3	1.44	Yoker	169.2	1.41	20.24	50,550
15.	Sheffield Corporation	3	332.9	1.58	Blackburn Meadows (New) ...	178.4	1.16	24.47	26,466
16.	Edinburgh Corporation	1	331.0	1.44	Portobello	331.0	1.44	22.19	102,100

who have to sell perforce in large quantities at very low rates, whether in bulk for retail distribution by other parties or to the large power users, who are perfectly able to put in reasonably large power stations themselves. The company which Mr. Taite quotes has produced remarkable results and these are typical of what has been done by the others.

One often hears it remarked that in the country there is very little electrical development. This statement is grotesquely untrue and the electrification of the countryside is proceeding at an increasingly rapid rate. The late Mr. H. A. Couves, in his article in the issue of April 16th, dealt with this point very fully and indicated the pioneer work done by the largest and oldest Power Company in this country. There is no doubt that the Electricity Commissioners could give very adequate testimony on this matter, but owing to the large use of overhead wires, the facts stare one in the face and we are rapidly approaching a condition when there will be very few villages or hamlets which will not have a supply of electricity.

This wide-flung network (I hesitate to call it "grid") has been, from the nature of things, almost entirely the work of the Power Companies and large supply companies of a similar nature. This is not by any means a disparagement of municipal enterprise, but it happens that there are very few cases in which municipalities have had to deal with areas of this type. One does not overlook the pioneer work done by such places as Chester and Aylesbury, nor the experimental areas operated by Bedford and Norwich respectively, but all these and other areas taken in the aggregate are very small and relatively unimportant compared with those supplied by the Power Companies.

The table on page 721, which is extracted from the Electricity Commissioners' Returns issued in 1936, gives details of undertakings generating over 300 million units per annum in the year 1935. It shows the number of stations in each group and the average fuel consumption per unit generated in that group, while in each case the most efficient station in the group is shown separately and particulars are given for this.

It will be noted that in all cases, following the Commissioners' tables, the energy referred to is "units generated." It might be pointed out that although, for convenience, the undertakings are placed in the order of the total units generated in the year, this is not necessarily the criterion of the size of the undertaking itself since, owing to the operations of the Central Electricity Board, some of the large stations export very heavily and others, according to circumstances, not so much, while in certain instances some of the larger undertakings import considerably more than they export.

This table does, however, show quite clearly that the larger sphere of operation of the companies has enabled them to erect and operate larger stations and that the efficiencies so obtained are certainly very remarkable. It can fairly be stated that the companies have given a good account of the stewardship placed on them by Parliament in that they have developed large and, in many cases, barren areas, that they have generated and transmitted with great efficiency and that they have made available low prices for bulk supply and power purposes, in addition to carrying out very considerable pioneer work in distribution proper, generally operating under Electricity Orders.

That very great progress has been made in spite of the difficulties of the task, resulting in the very strong position in which the companies to-day find themselves, is recognised in the McGowan Committee's report on Electricity Distribution, recently published, in the earlier part of which the following remark is made (Paragraph 162):—

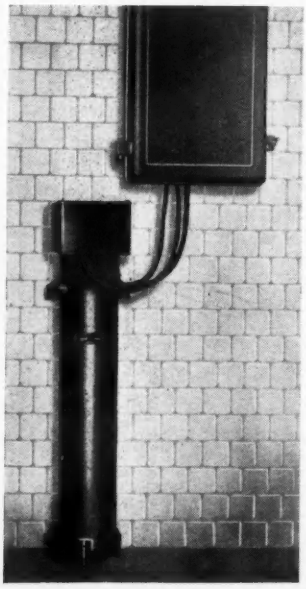
> "In the majority of cases it will no doubt be found that under an area scheme the Power Companies should be retained on a consolidated and improved basis, and if such consolidation is carried out on sound lines substantial benefits to consumers should accrue in the area as a whole."

This conclusion is incorporated in the conclusions and recommendations under (A) Organisation (Paragraph 471 (x)) and represents a reasoned opinion based on considered evidence and affords, were it needed, an indication of the great work which has been carried out by the Power Companies since the early days described by Sir James Devonshire.

Condensers for P.F. Correction

FOR a number of reasons, including practically loss-free operation and their extremely modest requirements as regards attendance, the use of electrical condensers for improving the power factor of industrial installations is becoming more and more prominent in preference to the employment of rotary machines.

The higher voltages at which condensers of increasing capacity are now being required to operate have enhanced the importance of such considerations as initial cost in relation to useful life. The more severe operating conditions have made it necessary to ensure that the dielectric, usually oil-impregnated paper, shall not be unduly subject to ageing.



A 30-kVA, 600-V, 3-phase Philips pressure condenser connected in feeder cables

A typical voltage/time-to-breakdown graph almost approaches a horizontal line over a considerable portion of its length. In the case of voltages lying slightly above the horizontal line slow deterioration of the dielectric takes place and may continue in service for many years before a breakdown finally occurs.

The cause of this deterioration is small air bubbles, which even the most careful vacuation cannot entirely remove. These bubbles ionise at voltages which are not dangerous to the paper and oil. As a result the oil gradually changes into a wax-like mass, hydrogen is released, and the paper fibres become carbonised. From this point the condenser ages and spool breakdowns occur with increasing frequency. The dielectric strength of gases increases approximately in direct proportion to the pressure, and, therefore, if the condenser is placed under pressure the weak spots, or air bubbles, will then be strengthened and thus the cause of ageing will be removed.

This principle of putting pressure on the dielectric has been carried out in the latest design of condenser manufactured by Philips Industrial. The condenser spools are mounted in a framework which is placed in a steel cylinder approximately ¼ in. to $\frac{5}{16}$ in. thick, the cylinder itself consisting of a seamless Mannesmann tube with round covers electrically welded to it. The cylinder is almost completely filled with oil and then nitrogen is introduced to give a pressure of between 250 to 300 lb. per sq. in. These cylinders, incidentally, are tested up to 1,000 lb. per sq. in. for strength and leakage. The patent chrome-iron-glass sealing process, used for many years in Philips electronic tubes, which has proved its reliability at great fluctuations of temperature is employed. The glass cylinder can support a pressure of 3,000 lb. per sq. in. while blows on it with a hammer are unable to cause any damage. The normal range of these condensers is from 5 to 100 kVA (R) at voltages between 300 and 17,000, and by grouping the various units, any desired capacity can be obtained.

The advantages obtained by this new type construction include extreme robustness; suppression of ionisation, giving a materially longer life; hermetic sealing, rendering penetration of air and damp impossible; very small floor space is required; and the condensers can be used in places where explosive gases are to be found.

A Large Electric Hoist

What is said to be the largest hoist in Canada has recently been installed at the Creighton mine, Ontario, of the International Nickel Co. of Canada. It occupies a floor space of about 65 ft. by 48 ft. and, according to *Electrical News and Engineering*, is driven by two 1,200-h.p. 400-r.p.m. d.c. motors fed from two 945-kW generators coupled to a synchronous motor on the Ward-Leonard system. A 17-kW 220-V exciter supplies the generators and hoist motor fields and also the control circuit. Another direct-coupled exciter provides the field for the synchronous motor. Operation of a master drum controller energises magnetic contactors in fixed sequence, whereby the generator fields are given the required polarity and values appropriate to the stages of working. Automatic timing of acceleration and deceleration is obtained by an inductive time-limit feature on the contactors. The motors and generators are tied together in one loop circuit in which is inserted a circuit-breaker with a resistance across its terminals to limit the dynamic breaking current and to absorb the kinetic energy in the hoist. Bi-cylindro-conical hoist drums, 12 to 25 ft. in diameter, are mounted in tandem on individual gear-connected shafts. Pinion shafts at each end of the train are connected to the motors. A net ore load of 18,000 lb. per trip is raised in balanced skips, weighing 10,000 lb. each, on a vertical shaft, the maximum output being 250 tons per hr. with a safe speed of 3,000 ft. per min.

Electricity in the Small Home. By G. S. Watts

Some conclusions from actual experience

THE object of this article is to clearly prove how the domestic side of electricity supply undertakings may be considerably increased, more especially in what may be termed "suburban villas."

In the early part of 1911 I commenced using an electric cooker made by Mr. F. E. Berry, and I well remember the thrill experienced at home the first Sunday we managed to prepare our dinner electrically. For several weeks before the actual installation, many visits had been paid to the cooking showroom next door to the "Alhambra" in Charing Cross Road, in order to become acquainted with the "latest method of cooking." In Ealing Berry's cookers (both "Duplex" and "Single"), were being let out at 5s. 6d. per quarter for the "Duplex" set, consisting of one plain and one ribbed plate, and an extra plate to place in the top hole of the oven. The "Single" set was 3s. 9d. per quarter. It was necessary to purchase a special grill plate, a kettle and saucepans made specially to lay flat on the plates, and the approximate cost of these extras was £2 10s. The cost of electricity was 1d. per unit—not too heavy considering that this was 26 years ago. The cost of cooking dinner for three averaged 5d.

Mr. Watts is chief commercial assistant to the Ealing Corporation Electricity Department

I kept on with this cooker until the early part of 1915, when it broke down, and it was decided to revert to gas cooking. On my return from overseas in 1919, I found the gas company had installed a new cooker which was giving satisfaction. Consequently, for several years I used electricity for lighting and a small amount of heating, gas for cooking, and coal fires.

In March, 1935, having moved to a new house, I decided that for a year I would confine myself to electricity for lighting, and part heating, gas for cooking, and coal for fires, bath water, &c., and would keep a strict account of my expenses in order to get exact costs, and then change over to "all-electric," as a test, for a year.

My expenses from April 1st, 1935, to March 31st, 1936, with three in family, were as follows:—

	£ s. d.
Gas	4 9 10
Electricity	5 9 11
Coal	6 15 0
Wood	10 9
Wood blocks	15 0
Total	£18 0 6

My house is just an ordinary villa such as is springing up all over the suburbs at an average cost of £1,000. It is assessed at £34 and has six rooms, scullery, bathroom, &c.

The electrical arrangements are as follows:—*Entrance hall*: One 15-W (2-way switching) lamp, plug for vacuum cleaner, bell transformer. *Dining room* (facing south): One 75-W lamp in centre, small fan, one 40-W floor standard, radiator plug (15 A), radio plug. *Drawing room*: One 100-W lamp in centre, 20-W standard, radiator plug (15 A). *Kitchen*: One 40-W lamp in centre, radiator plug, plug on wall for percolator, iron, &c., switch to operate immersion heater in bathroom with lamp indicator. *Scullery*: One 20-W lamp, a Revo No. 3[illegible] cooker with two 1,800-W plates (total 7,800 W) fitted with Igranic dual thermostatic control. During the past year there has been no trouble at all with the cooker.

Thermostatic Cooker Control

With regard to thermostatic control, all our cooking is done by numbers; the thermometer fitted on the cooker is really not needed. The numbers range from 1 to 12 and I have a chart giving the correct positions for various purposes. For instance, No. 7 gives 425 deg. F., and I know that a chicken can go in, &c. One great advantage gained from "numbered cooking" is that any number found suitable for joints, &c., can be inserted on the chart. I have arranged the thermostat connection so that when whatever number (temperature) is set, there is no need to worry to see when the indicator lamp is switched on.

In my house the radio is on from noon to 10 p.m. and a distinct "buzzing" on the loud speaker gives a warning that the cooker switch is about to operate. By this means the lady of the house is able to ascertain, in whatever room she may be, that the oven is ready and the "buzzing" is stopped.

A 1½-gal. "Aidas" water heater is fitted over the sink (set at 165 deg.). From careful tests made the average consumption is from 14 to 18 units per week. To my mind a small water heater over the sink is needed with every cooker. First thing in the morning, water is ready at 165 deg. to put into the kettle to boil in a few minutes for tea, shaving water, &c., and then after breakfast ready for washing up, and so on during the day.

There are 15-W lamps on the upstairs landing and in the lavatory. In the principal bedroom there is a 60-W lamp over the dressing table, and a 30-W lamp over the bed with a special switch. There is also a plug for a radiator and blanket. During the cold weather an electric blanket is switched on for two hours before retiring.

The second bedroom has a 40-W lamp over the dressing table and a 15-A power plug; the boxroom a 20-W lamp; and the bathroom a 40-W lamp and a 3-kW immersion heater.

In addition to the equipment already mentioned I have a vacuum cleaner, radiators (1 and 2 kW), and coffee percolator, electric clocks, and a massage set. During the past year I have made it a strict duty to read the meter before retiring for the night, and have recorded the actual daily consumption.

No coal at all was used from April 1st until the cold snap on September 27th. All bath-water during this period was heated by the 3-kW immersion heater fitted in the 25-gal. unlagged tank in the bathroom. The tank is above the kitchen where a switch is fitted with "light" control. No fire has been lighted in the dining room and drawing room during the year; in fact, I removed the fire-bars at the commencement of my test and fitted in the radiators instead. The only fire that has been used, and then for only a short time each week during the winter, is the kitchen fire which heats the bath water. During the day a 1-kW radiator is used if necessary in the kitchen.

With regard to the general saving effected by the installation, it was our usual practice to have a charwoman for two half-days per week, now one half-day a week is sufficient. The sweep has not been required once during the year.

More instruction should be given to girls in electric cooking in the schools, as it is very difficult to get housewives really interested once they have become accustomed to the latest gas cookers; another point that requires very careful attention is the time taken to heat the oven.

Details of Cost

In Ealing we have an all-in tariff with the fixed charge based on rateable value and a "unit" charge of ¼d. in the summer quarters and ½d. in the winter. My standing charge is £1 1s. 9d. per quarter.

The details of consumption and cost for the year under review were as follows:—

	Standing Charge.	Consumption Units.	Unit Cost.	Total.
	£ s. d.		£ s. d.	£ s. d.
June quarter, 1936	1 1 9	666	18 6	2 0 3
September quarter, 1936 ...	1 1 9	486	13 6	1 15 3
December quarter, 1936 ...	1 1 9	1,163	2 8 5	3 10 2
March quarter, 1937	1 1 9	1,360	2 16 8	3 18 5
Total energy cost ...	£4 7 0	3,675	£6 17 1	£11 4 1
Hire of apparatus				2 10 0
Gas				Nil
Coal				3 5 0
Wood				5 7
Total for year				£17 4 8

It will therefore be seen that the actual saving amounts to 15s. 10d. without taking into consideration the saving on sweep, charwoman, &c., to say nothing of matches. On each quarter's chart I have set out the average price per unit, and average consumed per day. I find that the total cost per unit for the whole year is 0.73d. My total expenses per week for this excellent service average 6s. 7¼d. per week.

I am arranging in future to do away with coal entirely, by installing a small tubular heater in the linen cupboard and using the radiator in the kitchen. I estimate my total consumption next year at 5,000 units.

Having now completed a two years' test and satisfied myself as to the economy of the system, I shall naturally confine myself to the use of electricity for my domestic use in future.

I consider that my experience shows that there is a splendid opportunity for the "domestic" load to be increased in small houses if the facts are more generally known.

Distribution Transformers.

By F. S. Naylor, B.Sc.(Eng.), A.M.I.E.E.

THE cost of losses in distribution transformers has been treated from time to time by various writers. They have been used as a guide to design by E. G. Reed in his book on the essentials of transformer practice, which although relating to American conditions, appears to cover the whole ground in a careful manner. British practice was treated in detail in a report by Mr. W. Fennell to the Overhead Lines Association, and arising from this a formula was adopted for a specification for rural distribution transformers. Mr. Charley, in his paper before the Belfast Association of Engineers, used this formula to bring out the effect on transformer design of the factor of revenue loss due to poor voltage regulation. In the ELECTRICAL REVIEW of September 4th, 1936, Mr. D. P. Sayers, discussing the importance of reducing the losses in distribution transformers wherever possible, included some useful suggestions for effecting this.

Three factors have to be considered in the design of distribution transformers in order to obtain the most economic unit.

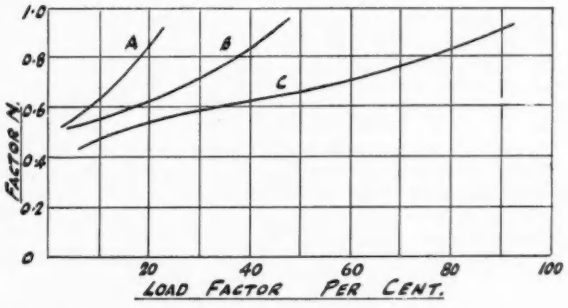


Fig. 1.—Values of factor N for various types of load

A. Pure lighting load assumed to exist for 25 per cent. of the year. B. Lighting and heating load assumed to exist for 50 per cent. of the year. C. Mixed lighting, heating and power load assumed to exist throughout the year.

First, the annual capital charges; secondly, the losses due to iron; and thirdly, the losses due to copper. Capital charges are based on the transformer having a life of twenty years as required by the Electricity Commissioners for loan repayments. This usually works out at about £8 per year per £100 of capital expenditure. Iron losses, usually incurred throughout the whole of the year, impose a maximum demand on the bulk supply at the time of the system peak and equal the fixed value of these losses multiplied by 8,760. The computation of copper losses can be simplified by employing loss factors. These are, first, the I^2R losses which, as in the case of the iron losses, have to be paid for on the bulk supply charges, and secondly, the loss of revenue due to poorer voltage regulation produced by the copper drop. A proof has been given in my recent paper* showing that if the copper drop in a transformer could be avoided then the increase in consumption by low-voltage consumers would be equal (subject to certain qualifications) to twice the value of the copper losses in the transformer. Offset against this there would be imposed on the bulk supply maximum demand an additional demand equal to twice the value of the copper loss maximum demand at that time. Both the gain in consumption and the increase in maximum demand on the undertaking are subject to a reduction, because radiators and lamps are composed of resistances affected by temperature, while the latter is subject to a further reduction due to diversity between the maximum demand of most distribution transformers and the system peak.

Calculating the Cost

All of the above factors are embodied in the following formula, in which reduction in revenue due to regulation has been kept as a separate item from copper losses, although items (3) and (4) are both, strictly speaking, losses due to the copper in the transformer. Fig. 1 has been included for calculating the losses due to copper.

The annual cost (L) of the losses on a distribution transformer is made up of: (1) Capital charges $=0.01p\times£$; (2) increase in bulk supply costs due to iron loss $=0.0365Id+0.001Ik$; (3) increase in bulk supply costs due to copper loss $=0.000365CFNd+0.001\,Ck/m^2$; (4) reduction in revenue due to regulation $=0.0065WFN\ (D-d)+0.018W\ (K-k/m^2)$ where p=interest and sinking-fund charges; I=iron loss (watts) at normal voltage; C=copper loss (watts) at full load; F=percentage load factor; N=factor (taken from fig. 1) expressed as a decimal; O=percentage regulation at unity power factor at full load; W=maximum kW in transformer; m=diversity factor, expressed in the form greater than unity (see fig. 2 for average figures); d and k=pence per kWh and £ per kW paid by the undertaking for the bulk supply; and D and K=average price per kWh and price per kW of m.d. paid by the consumers connected to the transformer.

The effect of cost of losses on the copper-iron loss ratio

The design of a distribution transformer depends essentially on the relative value of these losses. If we fix the cost of a transformer, then the only variables in the design are the iron and copper losses, and by means of the formula the ratio of iron to copper losses can be chosen to make the total losses a minimum.

Since the percentage regulation at unity power factor and full load on the transformer is related to the copper loss at full load, C can be substituted for OW in (4), which may be rewritten as $0.00065CFN\ (D-d)+0.0018C\ (K-k/m^2)$. Substituting coefficients for the fixed portion of each item, we have $L=I\ (a_1+a_2)+C\ (a_3+a_4+a_5+a_6)$.

If we consider a range of designs of transformers all of the same kVA output and of a given frame size within limits, the iron losses×copper losses are constant and in order that they may be at a minimum the following rule must hold: $r=a_1+a_2/a_3+a_4+a_5+a_6$. This equation means that the losses are a minimum when the annual cost of the iron losses equals the annual cost of the losses due to copper (*i.e.*, I^2R and revenue losses). Applying this equation to a 100-kVA transformer in a distribution sub-station supplying a domestic load, let us assume all consumers to be on a two-part tariff and all load to be affected by voltage drop with regard to revenue. Both assumptions are extremes, but are made for clarity. Under these conditions a somewhat high load factor is necessary in order to obtain an effective return on the cost of giving a supply.

Taking the cost of the bulk supply to the undertaking at £3 per kVA+0.19d. per kWh, the addition of the whole cost of distribution plus losses will increase these figures to £11 per kVA (or per kW at unity power factor)+0.21d. per kWh. In the example given below at 25 per cent. load factor on the distribution transformer with a diversity factor of 1.59 this is equivalent to a cost to the undertaking of 0.97d. per kWh at the services concerned. Fig. 2 shows the cost of supply for various load factors and also includes a curve of diversity factors which is fairly satisfactory for normal cases.

If 100 consumers each pay an annual fixed charge of £3.65 per annum and 0.6d. per kWh, the average revenue on this basis will be 1d. per kWh, which may be regarded as a minimum to safeguard the financial position of the undertaking. The high load factor of 25 per cent. is worthy of more than a little note, and I suggest that as a first step in considering any aspect of revenue loss due to poor voltage regulation it is essential to ensure a balance between revenue and the cost of supply in order to avoid considering purely fictitious cases. In a more normal case a mixture of consumers would have been assumed, with a resultant load factor considerably lower, but on the other hand, with a considerable proportion of them taking lighting supplies only with a relatively high charge per kWh.

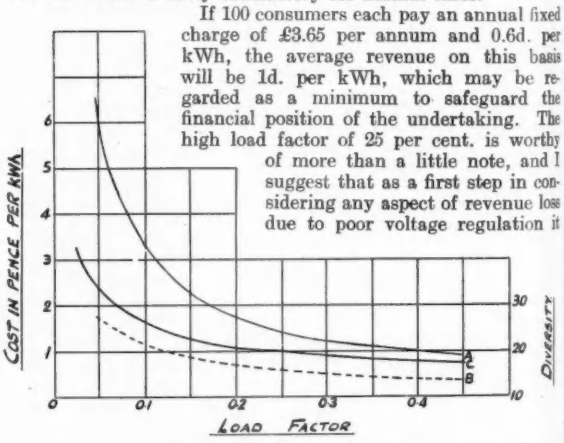


Fig. 2.—Total cost of supply

A. Cost per kWh at £11 per kW+0.21d. per kWh (no diversity). B. Average diversity factors.—C. Cost per kWh at £11/m per kW+0.21d. per kWh (diversity as curve B).

In the example quoted, where N (fig. 1) equals 0.65, the constants can be evaluated as $a_1=0.00695$, $a_2=0.00325$, $a_3=0.00113$, $a_4=0.00128$, $a_5=0.00444$ and $a_6=-0.00231$. If we take all the factors into account then, $r=C/I=a_1+a_2/a_3+a_4+a_5+a_6=2.25/1$, whereas if we exclude the loss of revenue component then $r=C/I=a_1+a_2/a_3+a_4=4.24/1$.

The ratio of approximately 4 to 1 is normal for this size of unit, but if the question of revenue losses is taken into

* "Loss of Revenue on Lighting and Heating Loads due to Poor Voltage Regulation." I.E.E., December, 1935.

Exhibits at the Royal Society

Many novel inventions

THE customary display of scientific apparatus and demonstrations arranged for the annual conversaziones of the Royal Society last week provided further examples of the value of radiography as a means of examination. For instance, there were X-ray pictures from the Crystallographic Laboratory, Cambridge University, illustrating investigations by Mr. J. D. Bernal and Dr. I. Fankuchen into protein from virus-infected plants.

Prof. H. Woollard employs X-ray photographs in his study of the lymphatic circulation in the human body, while Dr. A. J. Bradley's investigations into metallic alloys are assisted by X-ray examination (powder method). Alloys near the iron-copper-nickel-aluminium composition can be made into very powerful permanent magnets (one of which was exhibited) and Dr. Bradley has proposed an original explanation of the magnetic properties.

The industrial X-ray outfit of Adam Hilger, Ltd., is of the hot-cathode, shock-free, demountable type arranged for continuous evacuation. Various types of camera can be bolted to the tube and, together with the requisite transformer, the whole is contained in a mobile trolley.

When electroplating austenitic chromium-nickel steels the poor adhesion normally experienced has been considered to be related to the protective oxide film. Cathodic reduction of this film immediately prior to plating has given excellent results in the laboratory. The procedure was illustrated by one of Dr. W. H. Hatfield's exhibits from the Brown Firth research laboratories at Sheffield.

The research laboratories of the General Electric Co., Ltd., demonstrated an electron microscope and also a model of a multi-stage electron multiplier. The points of impact of the primary electrons were shown by means of a coating of fluorescent powder on the secondary electron emitting surfaces.

The electron image camera tube of Baird Television, Ltd., is an improved form of Farnsworth detector. The associated multiplier photo-electric cell is said to have a primary sensitivity of from 40 to 60 μA per lumen. The released primary electrons pass through a chain of electron-permeable grids, which liberate secondaries, and the resultant gain factor may, it is claimed, be as high as 100,000.

Novel "Motors"

Apart from a range of materials that are fluorescent to 3,650 A radiation (ultra-violet light) the British Thomson-Houston Co., Ltd., had on view a tiny motor with a selenium cell commutator. Its object was to demonstrate the conversion of luminous energy into electrical energy by means of photo-voltaic cells without separate excitation. The armature windings were connected to a pair of such cells, which were mounted upon the armature itself. When a beam of light was projected in a suitable direction on to the cells they generated currents that passed through the armature windings and caused rotation. The two cells, being alternately illuminated by rotation, were so connected as to act in an equivalent manner to the commutator of a normal d.c. motor.

Metallurgical specimens arranged by Sir Robert Hadfield included "Hadmang" uncoated electrodes and rods claimed to be particularly suitable for welding "Era" manganese steel. Various thermal effects were demonstrated. For example, a thermo-magnetic motor in the form of a wheel made of 25 per cent. nickel steel was so pivoted that a portion of its rim was in the field of a permanent magnet. When this portion was heated it became temporarily non-magnetic, a turning movement being thereby imparted to the wheel.

Differences between the temperatures of the magnetic change points of cobalt, iron and nickel were also illustrated, while a thermo-electric motor was formed of a cylindrical cage pivoted vertically between the poles of a magnet. Radial copper nickel wires formed the base of the cylinder and junctions with the vertical copper wires were made at their outer ends. A small flame placed near one of the poles of the magnet heated one of the junctions and generated thermo-electric current. Electro-magnetic reaction with the magnetic field of this current in traversing the remainder of the cage set up a rotary motion of the cage as other junctions were brought successively into the flame.

How the small e.m.f. of about 0.03 V developed by the combination of metals when a thermo-couple is heated can be made to energise a suitably designed electro-magnet was shown by the resultant force being so great that the magnet keeper could not be detached by hand.

New Instruments

Mr. G. S. Hartley's photo-absorptiometer is a null audio-detector for rapidly determining the concentration of solutions of coloured substances. A reflector system divides a beam of parallel light into two branches, one passing through an absorption tube and the other through an adjustable neutral glass wedge. The two beams are brought to a common focus on a single photo-electric cell, which is connected through an amplifier to a loud speaker. A siren-wheel causes the beam of light, before division, to oscillate without variation of total area. If absorption is unequal in the two branches, a note is heard in the speaker and can be eliminated by adjustment of the glass wedge.

[Elec. Rev. photo.

A 30-ft. high curtain of spray and water from a fire float on the Thames illuminated by about forty floodlights with colour changing devices

The new absorptiometer of Adam Hilger, Ltd., is designed for colorimetric chemical analysis. By placing two rectifier photocells symmetrically with respect to the light source and connecting them in opposition through a galvanometer, disturbances due to variations in the voltage applied to the source are avoided. Measurements are made by varying the light falling on the cells by means of a calibrated shutter and, since the galvanometer only functions as a null indicator, calibration is independent of the current-light characteristics of the cells.

An automatic polarograph from the Government Laboratory has an electrically operated pen for recording (in chemical analysis) current-voltage curves for a dropping mercury cathode which dips into a solution containing reducible ions or molecules. A pool of mercury or a calomel electrode serves as anode. A slowly increasing potential is applied to the cell thus formed by a rotating potentiometer directly geared to the recording drum. No current is passed by the cell until the reduction potential of the material in the solution is reached. At this point a further slight increase in potential causes an increase in current proportional to the concentration of reducible matter. The small currents involved are amplified by a galvanometer relay and a d.c. amplifier to operate the recording pen.

For measuring dielectric constants of gases and small quantities of liquids the Government Laboratory utilises a modified heterodyne method. A cathode-ray oscillograph is employed to compare the beat frequency with a fixed low frequency from a smaller oscillator.

Distribution Transformers

(*Continued from previous page*)

consideration, then this ratio should be materially reduced.

A further case illustrating the above points is that of a 25-kVA transformer in a rural area, the load factor of which is 15 per cent. Energy is purchased on the basis of 40 per cent. at 4d. per kWh for lighting and 60 per cent. at ¾d. per kWh for radiators (as, for example, in a large country mansion), the average cost working out at approximately 2d. per kWh. If we assume that the bulk supply costs £3.50 per kVA (or kW at unity power factor) +0.18d. per kWh, the diversity factor being 1.5, and N 0.58, then $a_1=0.00656$, $a_2=0.00325$, $a_3=0.000572$, $a_4=0.00144$; $a_5=0.0103$, $a_6=-0.00259$, then, (*i*) Taking all factors into account $r=C/I=a_1+a_2/a_3+a_4+a_5+a_6=1.01/1$. (*ii*) Neglecting loss of revenue component $a=C/I=a_1+a_2/a_3+a_4=4.9/1$.

The above cases illustrate the point that as soon as we consider the loss of revenue which must accrue due to the copper drop, then the copper losses become a more important factor, and the iron losses in this class of transformer become correspondingly less important. It is not easy to decide how much of the load is subject to a reduction due to low voltage, but it is evident that if we accept the fact that revenue loss occurs, then we must be consistent in our attitude to this matter and pay greater attention to copper drop when purchasing distribution transformers.

One of the National Physical Laboratory's exhibits was an instrument for measuring the dielectric constant and electrical conductivity of a material at frequencies from 10^4 to 10^8 cycles per second. The tuned circuit is of special form and includes two condensers each with micrometer adjustment, and a thermionic voltmeter for the detection of resonance. One of the condensers consists of two copper plates between which the material is placed; the other is of cylindrical form and provides a very fine adjustment. The measurement of dielectric constant is made by substitution of capacitance, and that of conductance by sharpness of resonance, all the readings being made on the two condensers. The apparatus was specially devised for the elimination of errors due to resistance and inductance in the electrodes and connecting leads, and has proved to be successful over a remarkably large range of frequency.

A machine was shown by the Cambridge Instrument Co., Ltd. (designed for Standard Telephones & Cables, Ltd.) capable of automatically gauging component parts within an accuracy of ±0.0001 in. and sorting them into a number of compartments. The Standard Co. itself showed an instrument designed for the visual examination or photographic recording of high-speed transient phenomena, such as voltage surges and cable breakdown tests. It is easily portable and operates entirely from a.c. mains. The cathode-ray tube beam and horizontal sweep are both initiated by the transient itself. A time-marking device is incorporated and events lasting from one millisecond down to one microsecond can be recorded.

A National Physical Laboratory device for automatically synchronising a radio receiver with a transmitter over the whole frequency range of the latter is operated by the currents resulting from the difference in frequency between the incoming signal and a local oscillation, after application to two resonant circuits. The resulting rectified currents are passed through a differential relay, controlling a reversible motor which in turn tunes the receiver to the signal. The device has been applied to the recording of echoes received from the ionosphere as the frequency of the exploring waves is varied continuously over a range from 2.7 to 5.2 megacycles per second. Other applications include the control of the frequency of a transmitter by synchronisation with a local oscillator of stable frequency.

Seismic prospecting apparatus exhibited by the Department of Geodesy and Geophysics of Cambridge University consists of six electromagnetic seismographs which record the vertical component of the ground motion produced by the explosion of a buried charge. The records of the instruments are made on a single piece of bromide paper moving about 20 cm./sec. The magnification used is limited by natural ground motions and is usually about 100,000. The apparatus is being used for the mapping of the paleozoic floor under south-east England.

A Fire Alarm and Ambulance Call System

THE Borough of Heston and Isleworth has recently built a new central fire station and has brought into service a comprehensive alarm system comprising a total of 76 street boxes arranged to work over six loop circuits. The boxes are of the latest "double-headed" type, placing both fire-alarm and ambulance-calling telephone facilities at the disposal of the public.

The fire-alarm mechanism is operated on the familiar "break glass-pull handle" principle, with safeguarding features. When once the outer door has been opened to replace a broken glass, or after the inner door has been opened for testing and inspection purposes, the box cannot again be closed unless the mechanism is fully wound up and all the testing components have been replaced. It is contained in a glass-fronted cover and is almost identically the same as that employed by the L.C.C. and can, when required, be fitted with an auxiliary magnet for remote control from hospitals, institutions, &c. A portable telephone can also be plugged in on the fire-alarm side when opened, thus enabling communication to be established with the fire station from the seat of a fire.

A loud-sounding spring-driven mechanical bell can, if necessary, be provided on the fire-alarm side of the street boxes; this is so designed that it will ring continuously for thirty seconds or more after the handle is first pulled. This feature will help to supervise points subject to repeated malicious misuse.

In order to gain access to the ambulance-calling telephone it is only necessary to break a small glass guard, whereupon the door swings open under the pressure of a spring and reveals the hand-microtelephone. The opening of the door automatically causes an alarm and a telephone-calling signal to be given at the fire station and, upon the telephone being lifted from its rest, the caller is put into communication with the officer on duty. The telephone is fitted with a weatherproof connection cord, and the circuit embodies an anti-sidetone feature to exclude street noises.

There are about 13 combined street boxes on each loop circuit, the wires of which are rented from the Post Office. The fire-alarm signals and the ambulance telephone calls are given over the same wires, without any delay or interference with the fire-alarm code signals. The entire system is on the closed-loop, positive non-interfering succession working principle, 50 mA normally flowing continuously round each loop circuit. Should a break occur at any point in any loop circuit then both visual and audible signals would be immediately given at the fire station and the particular loop circuit concerned would be automatically changed over to emergency earth-return working. Duplicate batteries of small capacity are provided at the fire station for each loop circuit.

The main switchboard at the fire station has seven panels, and, since all signals automatically cause an audible signal to be given, the entire system is under complete and continuous supervision. The street boxes have each a three-digit number and, when any box is actuated to give an alarm, the corresponding code is transmitted three times. At the fire station the code is rapped out on a loud-sounding gong, and is also recorded on the paper tape of the register equipment, being also timed and dated automatically. Simultaneously the alarm is given to each fireman on duty by means of the firemen's call-key apparatus.

The control desk and recording equipment. Inset: The fire-alarm switchboard

The installation, including the fire-station equipment and the street alarms, was carried out by the Automatic Telephone and Electric Co., Ltd., and embodies various auxiliary equipment to expedite the quick "turn-out" of the fire-fighting crew and machines, such as the automatic switching on of lights in the duty-men's quarters and in the engine room, the automatic starting of the fire-engines and opening of the fire-station doors, &c.

Meter Testing Equipment. By R. A. Westbrook

Type employed at Gillingham

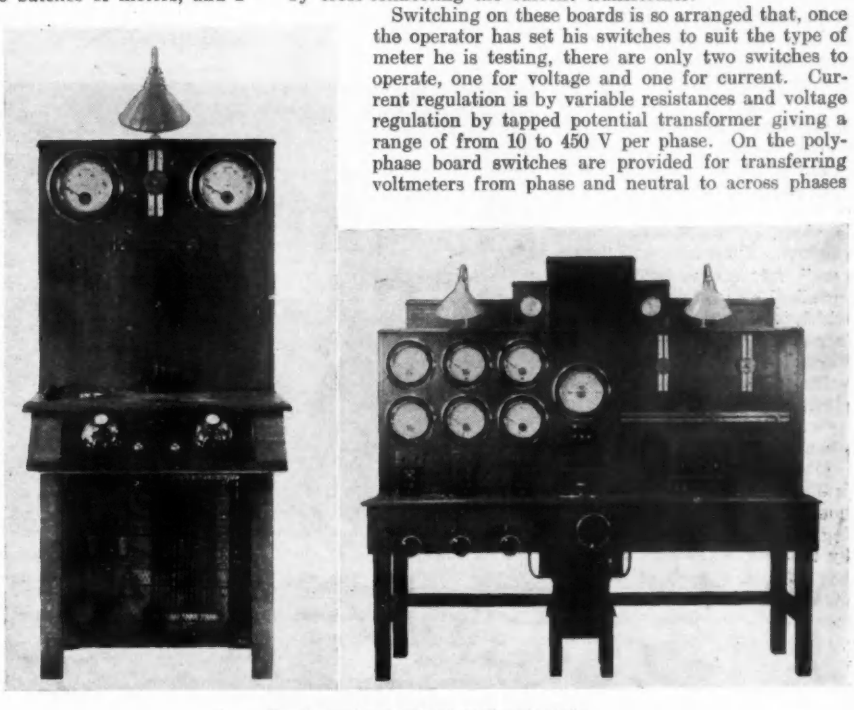
TESTING meters with the aid of a stop watch and wattmeter requires two operators, one for regulating the load and the other for the actual testing. Owing to the many types of meter encountered in test rooms it is not always practical to synchronise batches of meters, and I have found that it is quicker to test each meter separately against a rotary sub-standard instrument than to clock them. The second method is not so accurate as the first (although its accuracy can be very high if the rotary sub-standard is checked daily against a standard); nevertheless it is, in my opinion, more of a commercial proposition for the medium-sized test department dealing with a large variety of makes and types of meter.

When modernising the Borough of Gillingham's test room details relating to both single and polyphase types of test boards were carefully thought out in order to make them both flexible and simple and, at the same time, adaptable to the particular method of testing favoured. I designed and made both types of board actually in the test room, and their construction is within the scope of the average test room. While with a well-known meter firm I collected ideas, from the requirements of many supply undertakings, on basic simplicity of operation with flexibility and, at the same time, clean lines and low cost. An improved type of single-phase board is now under construction.

Each type works on the phantom load principle, and the ammeters on the primary side of the current transformers are not calibrated in amperes but in fractions of load, *i.e.*, one twentieth, one tenth, one quarter, one half, three quarters, and full. These markings hold good for all ranges of the current transformers and show in a clear manner the load on the board for any given range.

On the polyphase type of board the switching is so arranged that the circuit can be altered to suit any type of meter, whether single-phase, two-phase two-wire, two-phase three-wire, three-phase three-wire, or three-phase four-wire. Either wattmeters or rotary sub-standards can be employed, and for use with the latter an indicating power factor meter is provided. Phase angle is adjusted with a phase-shifting transformer on the polyphase type of board, giving any angle of displacement. On the single-phase board 0.5 lag is obtained by cross-connecting the current transformer.

Switching on these boards is so arranged that, once the operator has set his switches to suit the type of meter he is testing, there are only two switches to operate, one for voltage and one for current. Current regulation is by variable resistances and voltage regulation by tapped potential transformer giving a range of from 10 to 450 V per phase. On the polyphase board switches are provided for transferring voltmeters from phase and neutral to across phases and for switching each phase separately, short circuiting the primary windings of current transformers, and for starting current. On the single-phase type of board the controls are mounted on a sloping panel. Stud switches are provided for load and current range selection and the two main switches, one for voltage (400 V-off-230 V) and one for current (unity-off-0.5 lag). The rotary sub-standard instrument is let in flush with the table top.



Single and polyphase testing boards

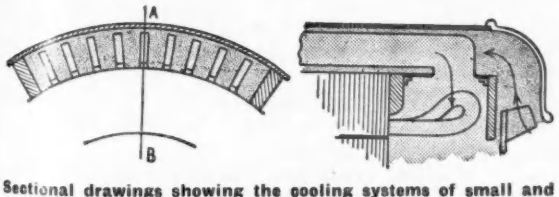
The boards are fitted with adjustable meter racks which clamp all types of meter rigid. While these boards were designed for the individual testing of meters, with longer racks synchronised testing can be carried out.

My thanks are due to the chief engineer, Mr. H. Hall, for permission to publish the foregoing particulars.

Cooling Totally Enclosed Motors

THE evolution of the totally enclosed fan-cooled motor is described by Mr. A. P. Mossay in a booklet issued by Laurence, Scott & Electromotors, Ltd. Artificial cooling came into use over 30 years ago, but in the earlier types (which are described) the heat was not extracted from the part at which it was generated.

The first heat-exchange design was that developed by the Société Alsacienne (1911) in which two series of air channels in the body (go and return) were connected to the interior of the machine. The cooling of the internal air in one channel by the outside wall and the fresh air in the two adjacent tubes was, however, partly neutralised by reheating from the internal wall formed by the stator core, in which the largest proportion of losses occur.



Sectional drawings showing the cooling systems of small and medium-sized motors

In 1917 Mr. Mossay, unaware of the existence of the French machine, reversed the functions of its alternate channels. Fresh air was brought into contact with the whole outside area of the stator surrounding the periphery of the hot-air channels, the end shields being made to act as distributors for fresh and inside air.

A year later the carcase was modified to form a single outside barrel with two small barrels cast integrally. The latter had vertical flanges and the punchings were supported by ribs between them. These flanges were drilled to enable transverse cooling tubes to be fitted and they were provided with arcuated apertures.

Two end shields were fitted to the flanges above the orifices of the cooling tubes, through which internal air was circulated by a fan, while the fresh air from an outside fan was deflected by a cowl through the apertures above the tubes in the space between the outer carcase and the back of the punchings, emerging by similar apertures at the other end. This construction increased the cooling surfaces for the same carcase dimensions.

In 1930 the stator laminæ of "Emcol" motors were welded to an outside shell formed by a rolled-steel barrel and to the spigots of the end shields, giving at both ends a rectangular space between any two ribs for receiving the bent ends of the cooling tubes. The latter occupy almost the whole radial space between the outside magnetic carcase and the outer shell, and in conjunction with the steel rectangular panel present a maximum of cooling surface to a straight air flow. A motor of this design differs from an open ventilated machine chiefly by the inclusion of the cooling device. For large machines additional cooling is secured by connecting air ducts in the laminations with the outside air. These methods are applicable to d.c. as well as to a.c. machines.

A Greyhound Racing Indicator Board

THE conversion to all-electric operation of the large indicator board at Harringay Stadium, which is about 130 ft. long and 33 ft. high, now enables it to display the detailed information which is necessary to greyhound racing at the appropriate time entirely by electric control.

The indicator is divided into two sections, one of which displays information regarding the number of the race and the distance over which the race will be run, also whether it is a hurdle, handicap or flat race. Runner numbers are also displayed, together with a special signal which draws attention to a dog which may have been withdrawn and a substitute entered instead. On this section of the board also appear the public visual indicators pertaining to the "win," "place" and "forecast" totalisators, which were installed by Totalisators, Ltd., which is adding six new and enlarged totalisator indicator dials to exhibit the prices in cash prevailing from moment to moment about each runner in the race upon which betting is taking place.

Movement of the 6-ft. pointers is effected by means of synchronous torque motors, the generating units of which are controlled by the ratio computing mechanism attached to each adding unit of the "win" totalisator. The operation of the dials is entirely automatic and the indication given to the public is actually the result of a continuous automatic computation of the ratio existing between the divisible pool and the number of units invested on each runner. The "Julius" totalisator adding machines are thus doing simultaneously and instantaneously six division sums, the divisors and dividends of which are increasing continuously as betting proceeds.

The second section of the board deals with "results." The whole of the indicators on this and other sections are of the Siemens mechanical type. They are controlled from switchboards in four different positions in the stadium, and the method of operation in each case is extremely simple, it being only necessary to operate the appropriate keys, all of which are clearly designated.

Each indicator is driven by a 1/20 h.p. motor running off the a.c. mains *via* a transformer and consuming 60 W. Revertive control is adopted, the key which has been operated being used to work the required indication and the indicator simply rotates until the marking is found when further movement is arrested by releasing the clutch.

The power plant for the control equipment consists of a 48-V, 65-Ah car type battery and a trickle-charging unit. The power plant is in duplicate. The installation has been designed to work in conjunction with the existing totalisator to the requirements of the Greyhound Racing Association. The whole of the equipment was designed and manufactured by Siemens Bros. & Co., Ltd.

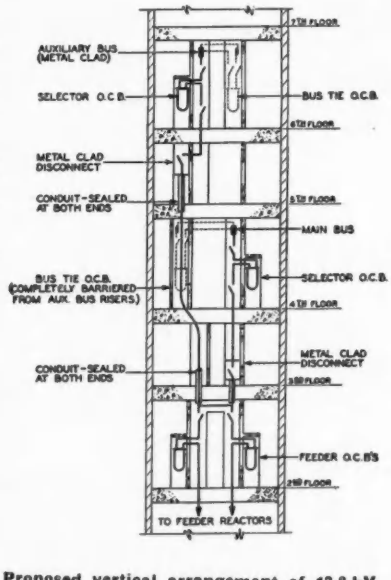
[*Elec. Rev. photo.*

The new indicator board at the Harringay Stadium

Alterations at Hell Gate Station

THE breakdown on the New York Edison system due to a bus-bar fault at Hell Gate generating station early last year was discussed in the ELECTRICAL REVIEW of February 25th, 1936. Modifications to the main switchgear layout are now in hand with a view to limiting the effect of any future failure. Hell Gate station has a capacity of 605,000 kW, of which 500,000 kW operates at 13.8 kV, 60 cycles and 105,000 kW at 11.4 kV, 25 cycles, a 35,000-kW frequency changer linking the two systems. The 60-cycle system is also interconnected with other large stations.

The existing 60-cycle bus-bars are of the horizontal isolated-phase type, both main and auxiliary bars being sectionalised through circuit-breakers and reactors on the sixth floor of the switchboard. Connections are generally made for pairs of feeders by two oil-immersed selectors (on the fourth floor) *via* a stub-bus to two breakers, one for each feeder, and to interconnectors and generators by two selectors and one breaker (two in parallel for the 160,000-kV alternators). Feeder and machine breakers are on the second floor, those for the main and auxiliary bus bars being on opposite sides of the walls which are separated by a passage containing the breaker connections.



Proposed vertical arrangement of 13.8-kV circuits at Hell Gate switch house

According to *Electric Light and Power* it is now planned to separate the main and auxiliary bus-bars entirely by placing reactors, breakers and selectors for the main bus-bars on the fourth floor and for the auxiliary bus-bars on the sixth floor. Risers to the latter will be completely walled off from the main bus-bars and its connectors. There will be double disconnectors on separate floors between each selector and its stub-bar, both of which will be open except when the stub is fed from the corresponding selector. As a safeguard against leakage from one floor to another, connections between disconnectors will be in conduit made gas-tight where passing through floors.

The six sections of the two sets of bus-bars are to be separated by double fire doors; generators and feeders will be associated to form units of balanced capacities, each 160,000-kW set supplying two sections. Feeder breakers are equipped with overload and earth relays and in some cases with impedance relays. The selectors have overload and the generators differential protection. Impedance relays are also used to provide bus-bar protection, the current through the bus-section switches, generators and major interconnectors being totalised in order to form the "course" of the impedance scheme.

Any fault in the bus-bar and connections up to section breakers, generator or feeder reactors (but not beyond these) will trip all associated section and selector breakers within 0.3 sec. The area of the copper earth connections of the generators has been increased and the neutrals of the two 160,000-kW alternators are to be earthed without circuit-breakers.

Radio Resistance Standardisation

The Radio Component Manufacturers' Federation announces the issue of a further supplement to its standardisation report of October, 1935, to cover work since done on potentiometers and variable and fixed resistances (not wire-wound and not exceeding 5-W rating), particularly in the translation of what was previously only recommended practice into definite standardisation. Copies (1s. 6d. each) are obtainable from the secretary at 83, Cannon Street, London, E.C.4.

Making Small Switches

An enlarged Ealing factory

WITHOUT doubt the Ealing factory of Arrow Electric Switches, Ltd., is one of the cleanest engineering works we have seen, and the resulting reaction of the employés to the almost office-like atmosphere in which they work certainly differs from that prevailing in many industrial establishments with which we are familiar.

Since our last visit two and a half years ago some 15,000 sq. ft. of productive floor area has been added to this one-storey factory, the whole of which is on ground level. Enamelled reflector lighting fittings hang from the glazed roof and air heating on the unit system is provided by means of overhead louvred enclosures, each containing a coiled hot water pipe and integral motor-driven fan.

The electro-plating shop has been re-equipped with Canning fixed and rotating barrel-type vats. In the machine bay additional power-driven tools have been installed for stamping out and forming metal parts. For instance, domestic cooker control boxes are now manufactured almost entirely on the premises. They are fabricated of sheet steel, guillotined and machine folded, with strongly welded corner seams and of very neat proportions.

While the height and width may be varied to suit requirements, a single depth of 2.5 in. has been standardised for all boxes in order to facilitate their mounting, either surface or flush. For the same reason all interior components are attached to a sub-frame, which may be removed as a whole without disturbing the box.

The standard switch, with a 30 A rating at 250 V, is smaller and lighter than the conventional iron-clad pattern. There is consequently less risk of the mechanical operating shock loosening the wall fixture. An extra small neon pilot lamp behind a bull's-eye lens and the three-pin auxiliary plug socket are separately fused, 5 A and 15 A, respectively, the box being drilled to take a separate plug switch if needed.

The standard 7.5 by 6 by 2.5 in. box is available with a differently arranged interior for the control of water-heaters and other appliances, the adjustable bottom making this range of control box adaptable for accommodating up to nine fuses, two switches, three indicating lamps and a separate sub-circuit switch if required.

The Assembly Shop

The works extension has added quite 10,000 sq. ft. of floor area to the main assembly shop. Waxing compound for filling holes in switch bases is kept fluid in electrically heated bench pots under thermostatic control (as are also the solder pots) with gravity ejection released by foot pedal. Switch parts are built up by girls with the aid of bench jigs and multiple electric screw drivers, interstage adjustment and examination being entrusted to men. Some idea of the fineness of the limits worked to is afforded by the fact that porcelain switch bases (made by Taylor, Tunnicliff & Co., Ltd.) are gauged within five-thousands of an inch.

Life and performance tests have hitherto been carried out by actuating switches in batches mechanically through motor-driven shafting, load being applied from a switchboard arranged to deliver up to 50 A at 240 V. A new control board is now being installed to furnish any amperage at voltages capable of being varied from 110 to 440 V, together with a Ferranti 3,000-V testing transformer.

Rotary single-pole cooker switches have been produced for over forty different series-parallel circuit arrangements. The former fixed-centre design has been modified to provide a "floating" spindle assembly within a plain porcelain well so that the rotating sections are allowed to assume their own levels, thus equalising contact pressure and wear, which tends to suppress arcing. The blade parts are built up in concentric layers, kept apart by short insulating tubes and separated by barrier discs. At half-assembly they are boiled in oil to seal the edges of the insulating discs and later pressed down to the requisite dimensions. The cam-actuating mechanism is self-contained within a metal cap that fits over the top of the porcelain well.

Among other products is a small rotary radio switch and a tiny q.m.b. single-pole push switch, the design of which has been slightly altered to dispense with the side clips that formerly retained the cover. In its stead a completely encircling metal band is now provided, so preventing the two halves of the moulded body working loose. A single hole suffices for mounting, and the rating is 2 A at 250 V. A clever movement is incorporated in the 5-A, 250-V domestic vacuum cleaner switch. The roller current collector is arc-proofed by the insertion of flash barriers, while bakelite enclosure is extended right up to the handle; provision is made for earthing. A somewhat similarly designed switch for portable workshop tools is arranged for thumb actuation and entirely encased in bakelite, so that the only exposed part is the contact itself.

A New Type

One of the newest items is a range of slow make-and-break rotary switches with coloured handles of modernistic style. Four or eight snaps are obtainable, three heats in series-parallel and a fourth heat for simmering. Robustness is assured by the simple action of cams on different levels in porcelain bodies, with phosphor-bronze blades and large silver contacts.

Control units are made up to customers' own requirements. Apart from rotary types from 3 A to 50 A at 250 V, d.p. tumbler switches of from 10 A to 50 A at 250 V q.m.b. are supplied with a pilot lamp, or separately switched plug and socket, in pressed-steel boxes with a sprayed cellulose finish and brushed aluminium or steel cover plate.

Beside flag indicators, a variety of miniature neon pilot lamps is offered for domestic and industrial appliances to operate at from 110 to 600 V in conjunction with midget resistors, the bakelite holder being arranged for mounting in several ways.

Any combination of push-button boxes with transfer switch and neon indicator is built up of interchangeable units for the remote control of magnetic contactor starters. The latest addition is a straight-on magnetic p.b. starter for small a.c. motors. The low-voltage release is self-reclosing on two-wire circuits, but not on three-wire, while the overload trip is of the bi-metal heater pattern and accessible from the front of the enamelled steel housing. Two sizes, single- and three-phase, are to be made available.

Finally, a thermostatic switch is being introduced. It is of the "Wilcolator" design and rated up to 20 A. Big silver main contacts are provided, in addition to which an independent cut-out is incorporated in the form of a push-down rod actuated by a cam under the rotary handle disc. This thermostat operates on the fluid rod expansion principle through a tiny bellows at the back. The dial is graduated from 150 to 550 degrees, a slot being provided at the top for an extra small neon pilot light tube.

Inspection and assembly at the Ealing works of Arrow Electric Switches, Ltd. [*Elec. Rev. photos.*

Televising the Coronation Procession

THE televising of the Coronation procession at Apsley Gate, Hyde Park Corner, on its return journey from Westminster Abbey, brought into service for the first time the B.B.C.'s new mobile television unit. Owing to technical reasons which limit the length of the cable connecting the television cameras with the control room, previous television outside broadcasts have been confined to the grounds of the London Television Station at Alexandra Palace.

The mobile television unit, designed and supplied to the order of the B.B.C. by the Marconi-E.M.I. Television Co., Ltd., consists of three vehicles each about the size of a large motor coach, the most important of these being a television control room containing all the equipment necessary for the operation of three television cameras. Special multi-core flexible cables, which can be up to 1,000 ft. in length, connect the "Emitron" cameras with this control room. The cameras themselves are similar to those installed at Alexandra Palace. The apparatus in the mobile control room is mounted on racks along the sides of the vehicle, leaving clear a centre passageway for the engineers operating the equipment. Two picture-monitors are mounted at one end of the van and while one of these is used to monitor the picture which is being transmitted, the other allows the picture incoming from the second camera to be inspected to determine its suitability for transmission. In addition, the vehicle is equipped as a small sound control room with all the necessary "faders" and amplifiers to deal with the four microphones which pick up the voice of a commentator and sounds associated with the scene being televised.

For conveying the picture signals to the television station at Alexandra Palace two methods are available. The normal channel is a Siemens television cable having characteristics suitable for the transmission of the very wide band of frequencies which is involved. This cable has been laid by the Post Office from Hyde Park Corner to Broadcasting House and from Broadcasting House to Alexandra Palace and forms part of a television cable at present being laid in the centre of London passing points of interest from which television broadcasts may be carried out later on. The alternative channel is provided by the second vehicle which contains a complete ultra-short-wave vision transmitter having a power of 1 kW for use with which a small easily erected aerial system has been designed.

One of the television "cameras" in action (left) and the mobile unit [*Elec. Rev. photos.*

Picture signals from the mobile control room are conveyed by means of a specially screened cable to this transmitter, and after radiation are picked up on a small aerial situated on top of the Alexandra Palace mast immediately above the main vision transmitting aerial. This aerial is connected to an ultra-short-wave receiver, the output of which is applied to the main vision transmitter and broadcast in the usual way. By the use of different wavelengths and special filter circuits it is possible to avoid interference between the signals being received from the mobile transmitter and those being re-broadcast from the transmitters at Alexandra Palace.

The mobile control room and transmitter are designed so that they can be operated from electricity supply mains. In situations where suitable mains supply is not available, however, the power for these two units can be supplied by the third vehicle which contains a petrol-engine-driven generator. This was not required at Apsley Gate.

Electricity Supply in Switzerland

STATISTICS published by the Federal Electricity Board of Switzerland, covering the hydrographical year to September 30th last, show that for the first time in any period of twelve months the total production exceeded 6,000 million kWh.

	Power Supply Companies.		Railway and Industrial Plant.		Total.	
	1934/5	1935/6	1934/5	1935/6	1934/5	1935/6
			(In million kWh.)			
PRODUCTION.						
Water power	4,349	4,603	1,312	1,419	5,661	6,022
Thermic power	10	8	21	21	31	29
Imports	13	4	—	—	13	4
Purchases from railway and industrial plant	58	54	—	—	—	—
Total	4,430	4,669	1,333	1,440	5,705	6,055
CONSUMPTION.						
Domestic, arts and crafts	1,225	1,231	11	11	1,236	1,242
Industrial :—						
General	563	532	126	130	689	662
Electro-chemical, metallurgical and thermal	224	254	554	631	778	885
Boilers	229	375	114	126	343	501
Traction	244	238	389	402	633	640
Distribution losses	547	550	80	84	627	634
Filling of storage lakes by pumping	48	22	1	2	49	24
Total inland consumption	3,080	3,202	1,275	1,386	4,355	4,588
Exports	1,350	1,467	—	—	1,350	1,467
Sales to power supply companies	—	—	58	54	—	—
Total	4,430	4,669	1,333	1,440	5,705	6,055

The increase of 5.9 per cent. in hydraulic production by power companies was greater than the increase in total production, due to smaller supplies from other sources. Inland consumption figures, including losses but excluding pumping back of storage water, advanced by 4.8 per cent. The increase in exports was attributable to the Klingnau power station, on the River Aare, which sells its entire output to Germany and had been in service for the first time for a whole year. The sales figures of industrial and railway plant recorded progress under practically every item.

The average output of power supply companies amounted to 80 per cent. of their mean capacity. The maximum demand registered was 762,000 kW (755,000 kW in 1934-1935), of which inland supplies accounted for 573,000 kW (551,000 kW). The annual utilisation of the maximum aggregate output worked out at 6,100 hours overall and at 5,600 hours for inland uses. Power consumption in winter is approximately 11 to 15 per cent. greater than in summer. Provisional figures for the last quarter of 1936 show an improvement of 7 per cent. in inland consumption as compared with the corresponding quarter of 1935. This is ascribed in part to expanding industrial demand following devaluation of the Swiss franc and Government rearmament orders.

At the end of 1936 the only power stations under construction were those of the Bannalp (Canton Unterwalden), with a rating of 5,000 kW, and of the Etzel (Canton Schwyz), rated at 80,000 kW and jointly owned by the State Railways and a power company. The year 1936 marked the completion of the Dixence scheme (Canton Valais) of 90,000 kW installed and 130,000 kW ultimate rating, which operates with a head of 5,740 ft., said to be the highest in the world.

Induction Regulators. By A. G. Powell, A.M.I.E.E.

Notes on types and control

INDUCTION regulators in general use on three-phase systems may be divided into three classes: Single-wound three-phase, twin three-phase and a single-phase bank. The application of the three types is principally determined by considerations as to whether or not phase displacement (*i.e.*, the existence of an angle between incoming and outgoing voltages) is allowable, and also by the degree of load unbalance that may be present between the phases. For interconnected feeders and for distribution systems feeding into a common network no phase displacement is permissible.

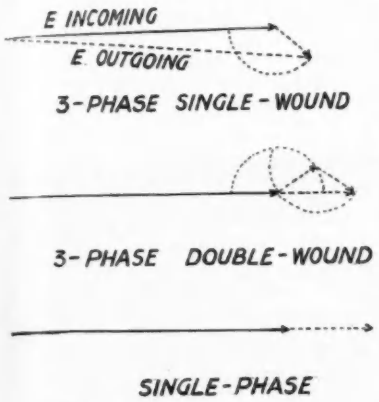


Fig. 1.—Types of regulators

The single-wound, three-phase type is the least expensive and is usually employed in ordinary distribution circuits where phase displacement is of no account. The induced secondary voltage is constant, but varies in phase angle from that of the primary according to the position of the rotor. When the rotor position is such that the primary and induced voltages are in phase the outgoing voltage is at its maximum, as these are then additive, and when 180 deg. out of phase it is at its minimum, as the voltages of the two windings are subtractive. For rotor positions intermediate to the extremes a phase displacement exists, the angle being at a maximum when the rotor is in the neutral (no buck or boost) position. With a regulator designed for a voltage variation of ±10 per cent. the maximum displacement would be about 6 deg. The displacement is independent of load, and the power factor is the same on each side if the small effect of magnetising current is neglected.

Where phase displacement must be avoided, as in interconnected systems, but where the load is reasonably evenly balanced between the phases, the double-wound three-phase regulator is generally used. In construction it comprises two regulators, each of half capacity, with their series windings connected in series and their shunt windings in parallel; they are mechanically coupled for simultaneous operation. The connections are made so that the phase rotation in the two regulators is opposite, and the phase angle introduced by one is, therefore, neutralised by that of the other. Hence there is no phase shift between the incoming and outgoing voltages.

Where considerable out-of-balance of load between the three phases is anticipated, as may be the case on four-wire distribution networks, it is often desirable to regulate each phase-to-neutral voltage independently, and banks of individually controlled single-phase regulators are employed. This scheme also commends itself in the case of very large units. Various methods of connection of the regulators are available, but with some phase displacement may be introduced.

The usual method of connection is with the primary windings in star with neutral point connected to the neutral wire as shown in fig. 2. No phase displacement is introduced in this case.

Connection of the star point of the regulators to the neutral wire is necessary in order to avoid instability. Where single-phase banks are employed on three-wire systems a balancer may be utilised to provide the neutral point.

With a bank of three single-phase regulators having their primaries connected between phases instead of between phase and neutral a phase displacement will occur, since the induced voltage is at an angle of 30 deg. to the phase voltage. The phase angle introduced in this case is opposite to that obtaining with a single-wound three-phase regulator, as it is nil at the neutral position and at maximum in the positions of maximum and minimum voltages.

In construction, the induction regulator lends itself to robust design; the connections between the stationary and moving parts are usually made by flexible connections, but in some cases slip-rings are used. The induction regulator is cheaper than a tap-changing transformer in the smaller sizes. It has the disadvantage, however, that, above comparatively low voltages, problems of insulation arise owing to the design being restricted by the necessity of winding the coils in slots.

In order to be able to withdraw a regulator from service without interrupting the supply suitable switching arrangements must be provided and generally interlocked to ensure correct sequence of operation. Single-phase and double-wound three-phase regulators, having a neutral position at which no boost is introduced, can be short-circuited when in this position and then cut out. In the case of three-phase, single-wound regulators, however, intermittently rated choke coils must be provided to allow of this short-circuiting.

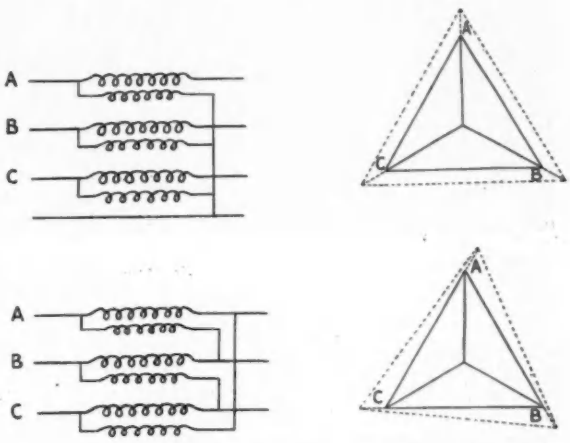
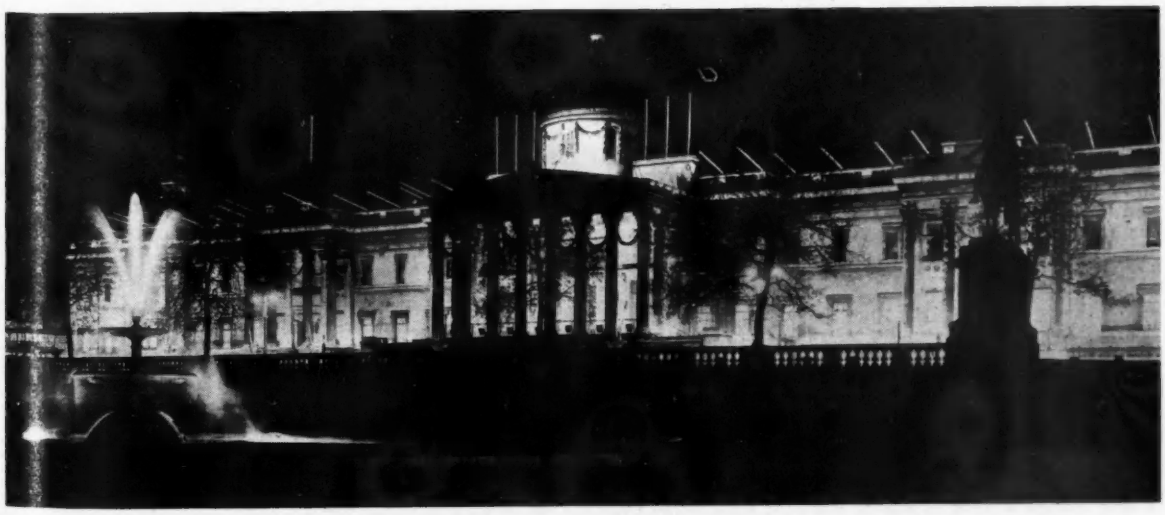


Fig. 2 (top).—Single-phase bank connected phase-to-neutral
Fig. 3.—Single-phase bank connected between phases



The floodlighting of the National Gallery by means of Ediswan equipment bringing out the architectural detail very satisfactorily

Correspondence

Contributions from readers are welcomed. The writer should give his name and address, not necessarily for publication

Aircraft and Atmospheric Electricity

The recent disaster to a German airship raises the question as to whether sufficient attention is being paid to the electrical equipment of aircraft in general and to the elimination of sparking due to oscillatory discharges in particular. Internal sparking when a complicated structure is discharged is possible, especially if aerial and lamp leads are brought from inside to outside through insulators.

The *Hindenburg* was an all-metal craft and it would appear that after passing through a storm it burst into flames when the structure was earthed, either through the mooring ropes or when the nose touched the mast. The electrical capacity of the craft was large and doubtless it was charged to a high voltage. Although there would be a considerable spark on grounding it is improbable that this caused the explosion, but a consequent internal discharge between portions of the framework may have exploded a gaseous mixture in the neighbourhood. The rule that lightning conductors should be laid as straight as possible should be borne in mind in this connection.

There is little doubt that the electrical damping of all-metal machines is considerably less than that of wood-fabric-metal machines and that therefore any sparking would be more intense. Instances have occurred of all-metal craft receiving damage to their wireless apparatus or ignition systems through atmospheric electrical discharges. There have been other cases of failure, the causes of which have not been cleared up because there have been no survivors.

I would suggest therefore that tests should be made on a suspended insulated all-metal machine, both with and without an aerial, to ascertain whether internal sparking occurs when the structure is charged and discharged. Any effects could be noted by an observer stationed inside, tests being made at increasing voltages, for safety reasons.

A small but strong committee should be set up to report on the general question. One calls to mind such matters as the rating and use of batteries, the adoption of aluminium for bonding and the use of contacts and accessories quite unsuitable for low-voltage circuits. In one instance a pair of ¼-in. contacts was used for starting a motor-generator taking up to 70 A. The use of electrical devices on aircraft is increasing and this ought to stimulate an investigation in order that so far as is humanly possible any cause of loss of life may be eliminated.

W. H. LAWES.

Stretford, *May 7th.*

Two floodlighted Thames-side buildings. Left: Electra House, Victoria Embankment, the headquarters of Cable and Wireless, Ltd. Right: Unilever House, Blackfriars *[Elec. Rev. photos.*

Static Electricity

I noticed the letter from Mr. S. J. Fleming in your issue of April 16th, on the subject of static electricity. The phenomenon referred to is quite common in Canadian houses during the winter. The continued cold weather dries the air, and when the air is warmed up again by steam or hot water radiators the relative humidity reaches a very low value. Under such conditions it is quite easy to get a spark ½ in. long by making two or three slides across a woollen carpet. I have seen a shower of sparks produced by stripping silk underwear rapidly from the body.

It is probable either that Mr. Fleming noticed these static charges during an unusually dry period, or the flats in question are air conditioned and the humidity controls were set to maintain too dry an atmosphere. The latter is the more likely explanation. In the first place it takes several weeks for all the furniture, walls and hangings in a house to give up or absorb moisture, so as to make a serious change in the relative humidity in the rooms A dry spell lasting for two or three days will probably not dry the house enough. In the second place, since the phenomenon was noticed in an untenanted flat, which presumably was left with all the windows closed, an air conditioning plant with a refrigerating unit would have a chance to dry the air and take the moisture out of the walls and woodwork.

The way to get rid of the trouble is to raise the relative humidity in the flat. I should be very interested to know if my diagnosis is correct.

C. E. OLIVE, *Chief Engineer,*
CANADIAN CELANESE, LTD.

Drummondville, Quebec, *April 29th.*

"Leakage Trip Protection"

In the article on the above subject which appeared in your issue of April 30th, the parallel-earth connection method is put forward as "recommended by the Home Office." I should be glad to know the authority for this statement, with reference to any specific regulation, and also whether any trips have been installed in this way under Home Office authority.

T. C. GILBERT.

Folkestone, *May 4th.*

Off-peak Supplies

The article by Mr. J. F. Elphick on off-peak supplies in your issue of April 30th was of interest to me. I find it rather difficult, however, to understand how the comparative running costs given at the end of the article are worked out. The author assumes in the case of electric thermal storage heating that the output will be 40 per cent. of the maximum, while in the case of coke firing he assumes that the output will be 60 per cent. of the maximum.

I would be greatly obliged if the author would explain this apparent inconsistency.

E. M. ACKERY.

London, S.E.26, *May 3rd.*

Miners' Lamps

I read with great interest the report on the lecture given by Mr. J. G. Garrett before the Junior Institution of Engineers in London, in your issue of April 30th. Mr. Garrett did not mention that the German lamp which won the £1,000 prize was the "Ceag" lamp which has been manufactured by a British company ever since the days of the War, when it passed out of the original German hands.

Many improvements have been effected since, such as the conversion from 2 V to 4 V, but the essential still remains, namely, the protecting fuse which comes into operation on the breakage of the bulb or wellglass, and this is regarded by many as a very necessary safeguard.

Barnsley, *May 6th.* MICHAEL WERTHEIM, M.A.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

An Improved Wash-boiler

A new "Creda" wash-boiler is being made by the SIMPLEX ELECTRIC CO., LTD., Credenda Works, Oldbury. The top rim and joint are specially designed to give strength, and the copper inner body is rolled over the outer body so that water cannot enter. There is a strong rolled double lap joint formed with a drip ledge to prevent condensation reaching the elements, and a fusible safety plug cut-out operates when the level of water falls dangerously low. Brass bus-bar connectors are provided, and the fixing studs are made watertight by a special press operation before tin is applied.

The new "Creda" wash-boiler

The outer body is of galvanised steel, and three cast-iron legs are fitted, the tap being chromium plated. A cowl protects the two foot switches, which are arranged to give low, medium and full heating. The capacity of the reinforced copper container is 10 gal.

A Photo-electric Meter

The introduction of a low-priced instrument for measuring light values by the AUTOMATIC COIL WINDER AND EQUIPMENT CO., LTD., Winder House, Douglas Street, S.W.1, should assist in the designing of lighting-system lay-outs, both in private houses and offices. It is of a handy size, measuring only 2 in. by 2½ in. by 1 in., and gives a range of 0-500 ft.-candles. The scale up to 10 ft.-candles is expanded to allow of accurate reading, and direct reading goes up to 50 ft.-candles. By inserting a perforated metal cover over the window the reading is multiplied by ten, giving a range up to 500.

The "Avo" light meter

The instrument, which is of the photo-electric type, is designed for use with gasfilled lamps or incandescent gas lighting, the reading being only approximate for other forms of lighting. The construction is based on the company's existing photographic light meter.

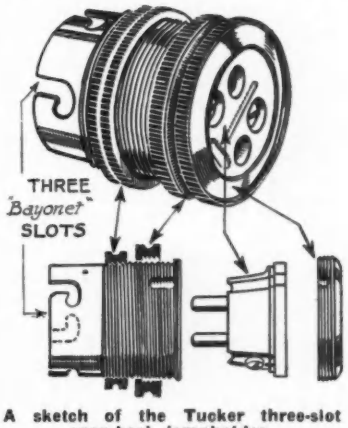
Stand for an Electric Iron

A recent introduction by HARBLOE PRODUCTS, 26, Gravel Lane, Salford, 3, is a stand for use with an electric iron. It incorporates a nickel-plated push switch which is wired in series with the electric iron so that when the iron is placed on the stand the supply is automatically cut off, thereby averting over-heating. It is suitable for any domestic voltage on a.c. supplies and is designed for irons weighing from 4¼ to 6 lb. Three-core flexible is provided. Cellulose enamel is the standard finish, but as an alternative a porcelain vitreous enamelled finish in mottled green, blue or brown can be obtained.

The "Harbloe" electric-iron stand

Three-slot Metal Lampholders

To the already extensive range of lampholders made by J. H. TUCKER & CO., LTD., King's Road, Tyseley, Birmingham, 11, two further special models in all the usual metal finishes have been introduced. These comprise a three-slot liner type with "J" slots spaced at 135 deg., 135 deg. and 90 deg., and an open-back type for easy wiring on signs, "flickers" on fires and other positions where the liner projects through a plate or flange and is clamped in position by a shade ring.



A sketch of the Tucker three-slot open-back lampholder

The three-slot type has been introduced primarily as a safeguard against pilfering in factories, public buildings, ships, &c., the spacing of slots corresponding with the standard three-pin spacing which is adopted by E.L.M.A. A further use is in connection with the new low-wattage discharge lamps and dual-filament lamps in which it is necessary to prevent the contacts being reversed. The open-back type (with two- or three-slot liners) is useful for signs and decorations as it provides for extra-rapid wiring in the minimum of space.

Floodlight Projectors

Two floodlight projectors have been added to the range made by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2. The smaller, moderately priced, is particularly suitable for general illumination purposes. The fitting has an aluminium body, polished and anodised inside, and a steel neck, while its stand is adjustable in all directions.

There is a domed stippled front glass to protect the 300-W "Osram" lamp. The overall dimensions are 18 in. high, 16 in. deep and 12 in. diameter.

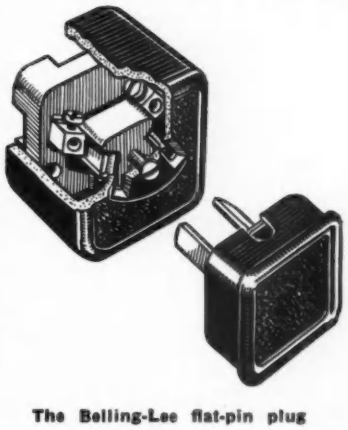
A moderately priced G.E.C. projector with adjustable stand

The second, which is of a larger and more sturdy character, has been designed for use in inflammable atmospheres and has been certified as flameproof in Group II by the Buxton Testing Station of the Government Mines Department. It can, therefore, be installed with safety for floodlighting oil works, refineries, chemical plants, &c. The body of the unit is of "Alpax" aluminium alloy and a stainless steel reflector is fitted. The front glass is armour plated, and the cast-iron base has an adjustable cradle. A 500-W "Osram" lamp is used with this unit, the overall dimensions of which are 22½ in. high, 20 in. deep and 18½ in. diameter.

Flat-pin Plugs

Made to B.S.S. 666, the new flat-pin plugs and sockets introduced by BELLING & LEE, LTD., Cambridge Arterial Road, Enfield, are suitable for radio speech circuits up to 50 W, and render it impossible to plug telephones or loud speakers into mains sockets.

All types are non-reversible and are supplied for flush or surface mounting. In the three-pin type the third pin is intended for a centre tap, earth or unsmoothed h.t., the second pin then becoming common h.t. and speech. Brown bakelite is standard, cream finish being supplied as an extra.



The Belling-Lee flat-pin plug

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New Domestic Laundry Equipment

ENCOURAGED by the increasing interest in domestic washing machines at least seven concerns have announced the introduction of new models. In the eight new "Easy" machines marketed by Herbert Bros., 67, Elwick Road, West Hartlepool, purchasers are offered a choice of three different cleansing actions—the vacuum cup, the "Spiralator" (in which, as its name implies, the agitator is in the form of a spiral), and the "Turbolator," a new method which aims at providing effective washing the whole way up the tub by the use of specially curved agitator vanes. The three new "Easy" ironers close to form handy tables.

The "Coronation Thor" machine, manufactured by the Hurley Machine Co. (England), Ltd., 55-59, Oxford Street, London, W.1, will find favour particularly among those who appreciate streamlining and attractive finishes. The bell-shaped tub is of extra-large capacity, holding 9 lb. of dry clothes. In another "Coronation" model, that of Beatty Bros., Ltd., Park Royal Road, London, N.W.10, the incorporation of a stainless-steel tub supported by four coloured rounded legs carried right up the exterior, produces a remarkably neat appearance and at the same time assists in rendering the machine more compact. An improved wringer, different types of gears and drive ensuring quieter running, and better draining are other features of this model, which has a 6-lb. capacity.

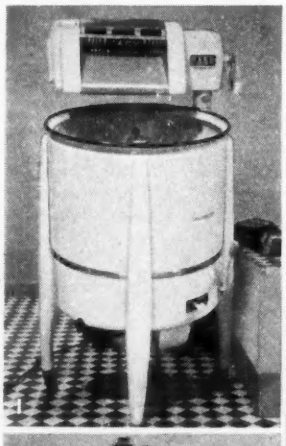
By the use of floating agitators in its four new machines the British Vacuum Cleaner & Engineering Co., Ltd., Parsons Green Lane, Fulham, S.W.6, claims that clothes are washed in the clean water at the top of the tub and that wear on the fabrics is consequently minimised.

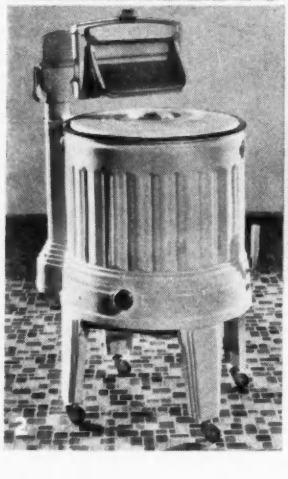
The tub is thermally insulated and special precautions have been taken to guard against electrical failures. Streamlined and cabinet models are included among the new machines, all of which will deal with a 9-lb. wash.

It is possible to regulate the temperature of the water for different fabrics in an automatic machine produced by Bendix Home Appliances, Inc., 16, Charles Street, Haymarket, London, S.W.1. No agitator is employed, and the extra large perforated metal drum, capable of holding 9 lb. of dry clothes, is made to revolve vertically by a ½-h.p. electric motor, a powerful jet of water being forced into the drum through a nozzle near the front. Only about one-fifth of the usual quantity of soap is said to be required, and the constantly flowing water provides a more hygienic wash. In appearance the machine, which is about the height of a table, resembles a refrigerator with a small circular glass front. Once set, it carries out all the operations of soaking, washing, rinsing and drying automatically, and even switches itself off. No kind of external wringing is necessary, and there are no exposed moving parts. Another new washer is the "Montgomery-Ward," sold by J. Toubkin, Faraday House, Todd Street, Manchester, 3. Three models are available, namely, the "special," "standard" and "*de luxe*." The "special" is a low-priced simple machine with a 16-gal. tub and a double-crown agitator, an adjustable pressure wringer which can be swung to eight positions, and a sliding lever agitator control. The *de luxe* machine holds 20 gals. to the water-line, is fitted with a cast-aluminium double-crown agitator, and 2¼-in. balloon rubber rollers for the wringer, which has eight positions.

The "Bendix" washer

Apex-Vactric, Ltd., Waterloo Road, London, N.W.2, is introducing a new washer known as the "Double Dasher." This incorporates a Lovell wringer with pressure indicator, while a special *de luxe* "Spin-Dry" model will wash, rinse, "blue," sterilise and dry the clothes. The same company has lately introduced a new ironing machine with thermostatic heat control. It is stated that even ruffles and pleats can be ironed with this machine.





Four washing machines which have recently been introduced:—1. "Easy"; 2. "Montgomery-Ward"; 3. Beatty "Coronation"; 4. "Coronation Thor"

Making Tinplate by Deposition

THE manufacture of tinplate is a very old industry and is carried out on a very large scale, but methods have not changed much. Hot-rolled steel is cut up into small bars which are separately rolled down to the requisite sheet form and then separately tinned. It is now possible to roll large ingots of steel continuously into strip form of a suitable thickness for tinning. This has created a need for some method of continuously coating the sheets directly. The possibilities of electro-deposition instead of the older hot-tinning process have consequently been investigated and both alkaline and acid baths have been tried. The latter is preferred and it would appear to be possible with this to electro-tin at speeds comparable with those used in hot-tinning, while keeping the length of the bath within practical limits.

It is relatively easy to subject a long strip of thin gauge metal to such electrolytic treatment as degreasing. From the mechanical point of view it is easy also to make such a process continuous, as long lengths of strip can be welded or stitched together economically in order that the material may be fed uninterruptedly through a plating bath. Thin coatings only need be considered, since for most purposes about 0.0001 in. suffices. Satisfactory results will depend largely on the degree of precision with which the plating process can be controlled to provide a uniformly satisfactory product under conditions of large scale production. Coatings vary from rough matte to smooth matte, or even semi-bright, but all require polishing to make them bright.

Quantitative data on polishing have been obtained by means of specially devised apparatus, allowing control of the pressure and speed of the polishing mop. By providing a transverse movement for the specimen the amount of polishing given to parallel strips can be controlled, and the drag of the specimens under the mop has also been measured. The loss due to polishing ranges from 7 to 20 per cent. of the weight of the coating; for smooth matte it is about 10-13 per cent. and porosity is doubled by it. Scratch-brushing causes less loss than polishing, but the porosity is much greater, except when brass-wire brushes are used.

The behaviour of electro-deposited coatings when the strip is deformed is important because tinplate is usually deformed during fabrication. The protective value of the coatings in the unstretched condition is very different from that after stretching, smooth matte coatings being greatly superior to the rough matte. This work is described in two papers which have been issued together as Technical Publication Series A. No. 52. of the International Tin Research and Development Council, and copies may be obtained free of charge from the Council at 378, Strand, London, W.C.2.

Computing Depreciation. By G. V. Harrap, A.M.I.E.E.

Accurate records necessary

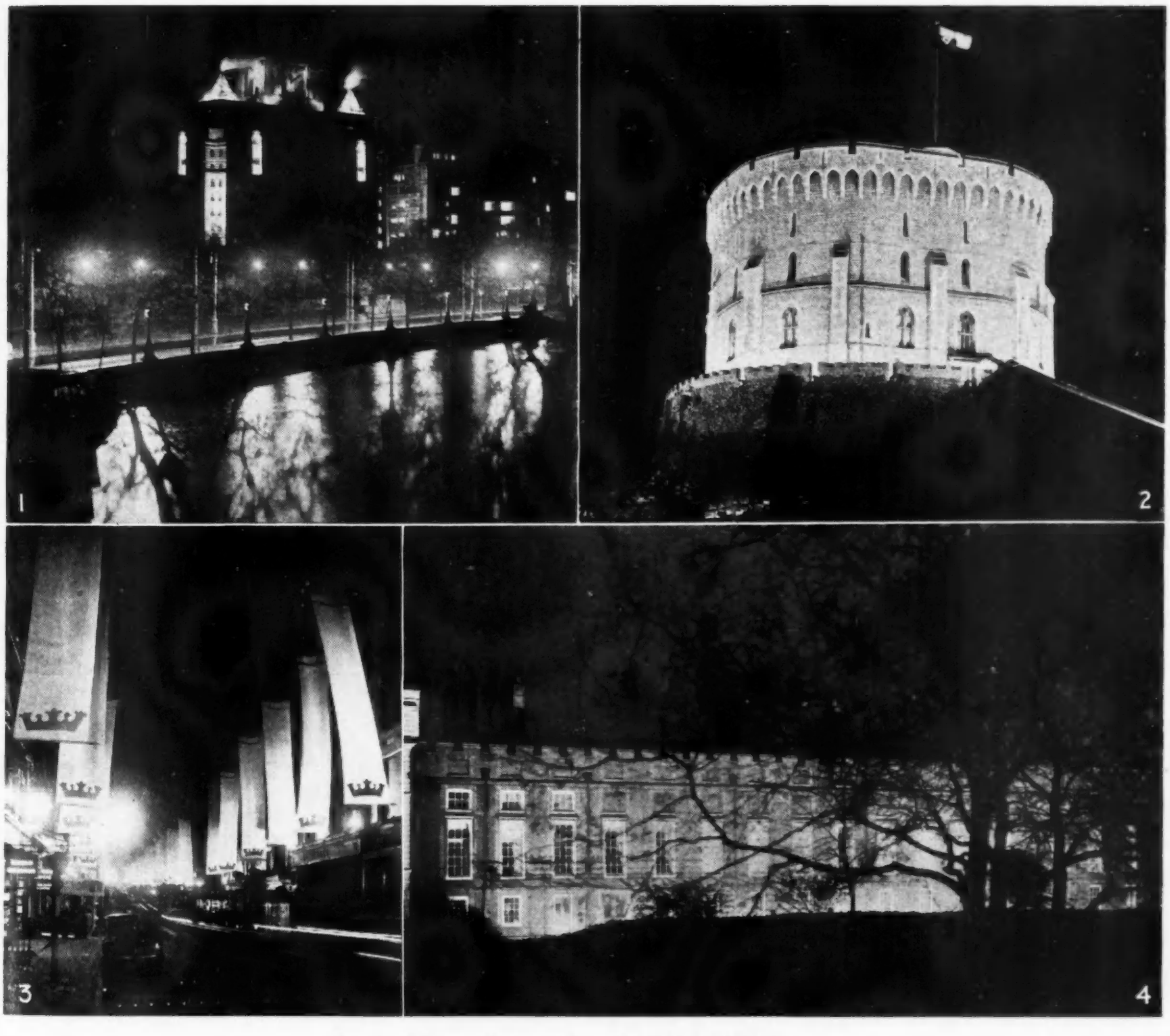
THE recommendations of the McGowan Report contained many implications of which note has been taken in the Press. Most of the discussion which has ensued has been confined to the technical side of distribution, and very little attention has been devoted to the financial side. Comments have, of course, been made upon the differing aspects of the transfer value of undertakings, but no critical examination appears to have been made of the details of finance that are bound to arise at the appointed time. The reverberations of the financial clauses of the 1926 Act are still with us, and it would be as well to examine any future Act with studious care to eliminate, as far as possible, similar causes of friction and dissatisfaction. Depreciation is one aspect of the transference of undertakings that will almost surely cause disputes.

Doubtless most responsible engineers are familiar with the proceedings relating to the transfer of the National Telephone Co. in 1912, and the arguments then advanced upon the methods of computing depreciation. Recently the position has been made a good deal clearer by the issue of the Electricity Commissioners' Order No. 714, although this only deals with statutory order as well as for the transference of undertakings.

When property is retired from service its actual service life is known. Up to this date its probable service life must be a prediction, but if this is based upon the actual service experience of similar property the error is likely to be small, particularly where expert judgment is exercised in determining the probable service life. Ordinarily, the probable service life of property is required for arriving at the depreciation expense, and it must, therefore, be determined in advance of actually taking the property out of commission.

"Expectancy of Life"

By observation and classification of the ages at death of hundreds of thousands of people actuaries have built up mortality tables by which the average life of human beings and the expectancy of life at any age can be accurately determined. Similarly, engineers and industrial statisticians have assembled the life histories of many types of industrial property units from which they are enabled to forecast the probable lives of similar units still remaining in service. The



Some More Coronation Lighting Schemes.

1. Shell-Mex House, showing the two beacons with electric smoke and flame effects. 2. The Round Tower, Windsor Castle. 3. Bond Street. 4. St. James's Palace

transmission lines and generating stations taken over by the C.E.B. Without giving specific instances, I submit the following comments for consideration by those in a responsible position in this matter

Probable Service Life

The production costs and profit or loss from the operation of any enterprise making use of physical equipment cannot be determined without consideration of the depreciation expense which is dependent upon the service life of the property utilised in the production processes. Knowledge of the probable service life of physical property is especially important in connection with the regulation of rates and prices by estimation of life expectancy for a single unit or a small group of units may be in considerable error. However, the probability of error is reduced when the service conditions of the property are taken into consideration and evaluated by engineers of expert judgment, the estimate being revised from time to time as the life history of the property unfolds.

Accounting regulations, and books on engineering valuation, together with certain statutory regulations, contain tables giving estimated average lives for many types of industrial property. In the absence of specific retirement records and experience definitely applicable to a specific property, these general tables are valuable in establishing a tentative figure for the probable life for use in setting up depreciation charges

for new properties. More recently, engineers and cost accountants have been giving much attention to the study of retirement records as an aid in the determination of average lives. These studies take into consideration the distribution of retirements as well as the mean age at which retirement occurred, thus paralleling actuarial methods and therefore being far in advance of past practices. As these methods are further developed and information about them disseminated, they will probably be more widely used.

Salvage value is not a factor affecting average life, but rather one which is dependent upon conditions at the time of retirement. Before depreciation expense or present worth can be determined, however, the salvage value must be estimated.

As public utility regulation, industrial cost accounting, and taxation schemes increase in complexity additional stress will be placed upon depreciation as a production cost factor, thus increasing the necessity of determining the probable service lives of property units more accurately than is at present practised. Furthermore, the probable service life of a physical property is not a static factor. It must be redetermined periodically if acceptable accuracy is to be maintained.

Published Tables Only a General Guide

Production equipment undergoes very rapid and continuous improvement in quality and material changes in capacity, and is continued in service or removed from service in accordance with economic conditions or management policies rather than because of its physical condition. Furthermore, in the case of certain equipment, maintenance practice greatly affects the average life realised, and therefore, the experience of one undertaking may differ considerably from that of another similar organisation. Thus, probable lives taken from published tables should be used only as a general guide in establishing a reasonable range of expected life of particular properties. The reliable method is to maintain adequate records of service, installations, retirements, and inventories from which the service lives of the units of a specific property can be determined frequently. A continuous inventory of physical properties is highly desirable.

While I strongly recommend the development and use of retirement data and survivor curves as the basis of estimating the probable life of property units, I do not mean to imply that expert judgment should be supplanted by purely statistical treatment. Each individual item, each group of items, and each property or undertaking must be dealt with in the light of its present condition, its character and amount of service or production, and its relation to the present and probable future economic trends, art of manufacture, and management policies. Tables of probable service lives, type survivor curves, and statistical methods are simply means of recording past experience to use in predicting what the future service of plant is likely to be.

New Books

The Transmission and Distribution of Electrical Energy. By H. COTTON. Pp. 452; figs. 274. London: The English Universities Press, Ltd. Price 21s.

As stated in the introduction, this book has been written with the object of fulfilling the needs both of the student and of the engineer in practice. Thus the student obtains an insight into the practical aspects of his subject, while the engineer in practice is reminded of the fundamental aspects of the problems with which he has to deal.

A glance at the table of contents shows that the extensive ground implied in the title has been well covered. Chapters are given on supply systems, distributors, feeders, line constants, short and long transmission lines, corona, inductive interference, insulators, mechanical characteristics, cables, voltage control, circuit-breakers, protective gear, travelling waves, and lightning protection. The book contains more practical information than one would expect to find in a volume of this type, and the chapter on circuit-breakers, for example, is particularly good from this point of view. The mathematical treatment is also essentially practical, although rather loosely expressed in some cases. The inclusion of a chapter on inductive interference is praiseworthy, but only interference under normal system conditions is considered. Some consideration should be given to interference under fault conditions in the power system as it is only under such conditions that trouble is usually encountered in practice.

The book is well printed and misprints are few, while the text is illustrated with numerous excellent diagrams. To sum up, it is a well-balanced treatise, neither the theoretical nor practical aspects of the subject being over-emphasised, and both students and practical engineers should benefit from its perusal.

Troubles of Electrical Equipment. By H. E. STAFFORD. Pp. 330, figs. 297. London: The McGraw Hill Publishing Co. Price 18s.

The title of this book, with its sub-title "their symptoms, causes and remedy," correctly describes a large part of the contents of this book. The equipment referred to includes electrical machinery with its accessories, such as starters, controllers, transformers, breakers, relays, lightning arrestors and voltage regulators. The text is amply illustrated and good use is made of tabulation. One strange error occurs in the section in the table on d.c. motor troubles.

Symptom.	Trouble.	Cause.
Series motor runs away.	Armature current too great.	It is the nature of a series motor to accelerate speed if the load is decreased. . . . This is due to the building up of increased flux in the field, increasing the counter e.m.f., and a greater current through both field and armature.

Such excursions into theory are apt to destroy the reader's confidence. It is, however, for practical information that this book will be consulted.

Much of the information on subjects such as industrial motor control, factors determining the economic use of power and power factor, is in a useful form, but some of the illustrations mean very little; *e.g.*, the photograph showing the instruments used in making a load survey. Such calls for adverse criticism are, however, few and far between. No doubt the book will be welcomed because of the large amount of practical experience it places at the reader's disposal.

Thermionic Valves in Modern Radio Receivers. By A. T. WITTS. Pp. 192; figs. 114. London: Sir Isaac Pitman & Sons. Price 8s. 6d. net.

The detailed technique of radio reception has changed so much in the last few years that an accurate and concise description of the operation of up-to-date circuits, as given in this book, should be welcome not only to amateur experimenters, but also to students and radio service engineers. The author is careful to avoid reference to circuits which are now obsolete, and to make use of only the simplest mathematics in his explanations. The first quarter of the book deals with electron transmission and the fundamental characteristics of valves, the remainder with the various uses of valves in receiving circuits; that is, for detectors, amplifiers, output stages, frequency changers and automatic volume control.

The book is well produced and provides a good summary of the theory and practice of radio reception in present-day circuits.

The Electrical Equipment of Automobiles. By S. PARKER SMITH. (Third edition.) Pp. 250; figs. 105. London: Chapman & Hall, Ltd. Price 6s. net.

Although the modern automobile is regarded as a petrol vehicle, its electrical equipment plays a principal part in securing regular running on the road. Hence those who are responsible for successful operation, such as men employed in motor service stations, must be thoroughly acquainted not only with methods of dealing with the troubles in connection with such equipment, but also with the underlying principles.

This was the purpose of the author when, ten years ago, he first compiled this work. The call for a third, revised and enlarged, edition is evidence that it is meeting a definite want. Its eight chapters cover every section of the subject, beginning with the storage battery and concluding with a section devoted to faults and their location. One chapter deals with engine starters in an exhaustive manner, drawing attention to many factors associated with the motors that are not generally appreciated and giving several hints likely to be useful to private motorists as well as to motor mechanics.

Examples of the up-to-dateness of the work are to be found in the discussions on starting the modern heavy-oil engine and on earthing the positive rather than the negative pole.

Since the inauguration in 1934 of the I.A.E. Repair Certificate Scheme, which embraces a written examination under the auspices of the City and Guilds of London Institute and a practical test by the Institution of Automobile Engineers, much more attention is being devoted to automobile electrical equipment. There is to-day hardly a technical institute in the country that is not including in its curriculum evening classes for the benefit of motor-repair mechanics. In this effort at improving the efficiency of service station employés the mechanical side has, so far, attracted greater attention than the electrical. This book should, however, assist in securing increasing prominence for the electrical section, and can be recommended not only to mechanics, but also to those who give instruction in the maintenance of automobile electrical equipment.

Television Cyclopædia. By A. T. WITTS. Pp. 151; figs. 97. London: Chapman & Hall, Ltd. Price 7s. 6d. net.

This book does more than give definitions of words, terms and expressions used in the science and practice of television. It provides a description or outline of the principles used in the more successful systems.

For the most part the explanations are accurate and lucid, but there are a few exceptions. Demodulation is given a sole meaning, *viz.*, that customary in America but not that usually assigned to it in this country. On page 55 on the subject of "Gettering" the sentence "The vapour . . . settles on the bulb and imprisons the gas that is subsequently given off by it" is likely to confuse the uninitiated.

The many diagrams are clear, well drawn and particularly

helpful in following the mode of functioning of the intricate devices described. The book properly includes many optical principles that have an application in television, and these, too, are well explained, while a number of optical diagrams are given. Cross references are very frequent and, in some paragraphs, are somewhat overdone.

Considered as a whole, the book is a useful contribution to the subject of practical television of especial service to those unfamiliar with its highly technical vocabulary, and is as up to date as can reasonably be expected if we have proper regard for the rapid developments occurring.

Connecting and Testing Direct-current Machines. (Second edition.) By F. A. ANNETT and A. C. ROE. Pp. 302; figs. 66. London: McGraw-Hill Publishing Co., Ltd. Price 18s.

This is one of a series of books on rewinding electric machines, and it now appears in its second edition after eleven years. The main alteration is the addition of six chapters to bring the work up to date. The division of the material is as before.

The first part deals with reconnecting d.c. armatures for a change in voltage, speed, or both. It is doubtful if many repair men are so much interested in this branch of the business. Repairing a motor is a very different matter from rebuilding it for other conditions when rewinding forms but a small part of the total cost. In such cases a new up-to-date design may be preferable.

The second part, on testing machines, is really what the repairer needs, for here he is taught how to find and repair faults in armature and field coils. This part has much practical information and, on the whole, it is well illustrated. The diagrams are generally made in a workmanlike manner, though in one figure the tester has to turn away from his work in order to read a voltmeter behind him. Generally, however, great care has been taken with the illustrations, and the book is remarkably free from useless photographs. The ground of the repairer's work seems to be well covered, and all kinds of faults are discussed. The added chapters include testing of lap-wound armatures with equalising connectors, and a new method of applying high-frequency voltage to coils or groups of coils. Probably the book is as good as any there is on the subject, and it has been written by practical men for practical men.

Shorter Notices

"The Physics of Electron Tubes," by L. R. Koller. (Second edition.) Pp. 234; figs. 84. Price 18s. "Electrical Measurements," by H. L. Curtis. Pp. 302; figs. 66. Price 24s. "Applications of the Method of Symmetrical Components," by W. V. Lyon. Pp. 579; figs. 255. Price 36s. London: McGraw-Hill Publishing Co., Ltd.

"Decibel Notation and its Application to the Technique of Power Transmission," by A. Morris. Pp. 57. Epsom: Dorking & Co. (Epsom), Ltd.

"Utilisation of Electric Energy," by E. Openshaw Taylor. Pp. 342; figs. 148. Price 21s. "Electrification of Agriculture and Rural Districts," by E. W. Golding. Pp. 244; figs. 67. Price 16s. London: English Universities Press, Ltd.

"Telegraphy and Telephony Definitions and Formulæ for Students," by E. Mallett. Pp. 37. Price 6d. "Examples in Thermodynamics Problems," by W. R. Crawford. Pp. 165; figs. 56. Price 5s. net. London: Sir Isaac Pitman & Sons, Ltd.

"Synthetic Rubber," by W. J. S. Naunton. Pp. 162; illus. London: MacMillan & Co., Ltd. Price 7s. 6d. net.

Parliamentary News (BY OUR SPECIAL REPORTER)

Naval Engineer Officers

On May 5th Lieutenant-Commander Tufnell asked the First Lord of the Admiralty whether he had any announcement to make regarding the entry of university graduates into the Royal Navy as engineer officers.

Sir Samuel Hoare said that the Admiralty had just adopted a scheme which would allow qualified candidates of universities of Great Britain and Northern Ireland to enter the Royal Navy as engineer officers. Under this scheme commissions as sub-lieutenant (E) would be offered to graduates between the ages of 21 and 25 who had spent at least three years as internal students and had an engineering degree (mechanical or electrical) which was accepted by the Institution of Mechanical Engineers as exempting from parts (A) and (B) of the examination for associate membership and had sufficient practical experience.

Power Prices in South Wales

On May 5th Mr. Temple Morris asked the Minister of Transport what was the average price of electricity available to factories in South Wales, and whether he proposed to take any steps to cause a reduction in such prices in order to provide a greater inducement for new industries to settle in that part of Great Britain.

Mr. Hore-Belisha said that the average prices for power supplied by the principal undertakers in South Wales ranged from 0.4d. to 0.7d. per kWh for high-voltage supplies and from 0.94d. to 1.65d. per kWh for low-voltage supplies. The only power which he had with regard to prices was to vary the authorised maximum prices if an application was made to him by interested parties in accordance with the Electricity Supply Acts.

Bills Advanced

In the House of Lords last week the Southern Railway Bill and the Kent Electric Power Bill (which includes provisions for the erection of a large station at Stone, Kent) were read a third time and passed.

The London Passenger Transport Bill received its second reading.

Adjournment

Parliament adjourned for the Whitsun recess on May 6th. The House of Commons reassembles on May 24th and the Lords on May 25th.

United States Electrical Exports

Continued recovery

AMERICAN export trade in electrical machinery and appliances last year, with a total value of $91,345,000, was 20 per cent. more than in 1935 and more than twice the value in 1933, after which year recovery began. From the following figures, which have been extracted from the official United States returns, it will be seen that the advance on 1935 spread through every important group and was notable in the radio and domestic appliance trade, the greatest increase occurring in household refrigerators.

	1936. $ (000).	Inc. or dec. on 1935. $ (000).
Generators, d.c.	345	+ 83
Generators, a.c.—		
Under 2,000 kVA	246	− 28
2,000 kVA and over	116	− 166
Steam turbine generator sets	255	+ 51
Accessories and parts for generators	685	+ 330
Arc welding sets	720	+ 217
Self-contained lighting outfits	650	+ 365
Storage batteries, 6 and 12 V	1,223	+ 112
Other storage batteries	595	+ 52
No. 6 dry cell batteries	196	− 41
Flash-light batteries	2,300	+ 338
Radio B and C batteries (dry)	452	+ 109
Other dry and wet cell primary batteries	137	+ 26
Power transformers, over 500 kVA	354	+ 256
Distribution transformers, 500 kVA and less	448	+ 91
Instrument transformers	147	− 2
Other transformers	389	+ 126
Double-current and motor generators, dynamotors, synchronous and other convertors	529	+ 259
Switchboard panels, except telephone	410	+ 108
Power switches and circuit breakers over 10 amp.	1,102	+ 148
Fuses	138	+ 15
Watt-hour and other measuring meters	446	+ 53
Electrical indicating instruments	533	+ 16
Electrical recording instruments	274	+ 18
Other electrical testing apparatus	949	+ 201
Lightning arrestors, choke coils, reactors and parts	452	− 46
Motors, 1/3 h.p. and under	679	+ 139
Motors, over 1/3 and under 1 h.p.	296	+ 87
Stationary motors, 1–200 h.p.	1,350	+ 332
Stationary motors, over 200 h.p.	116	− 87
Railway motors	140	+ 64
Electric locos., mining and industrial	429	+ 73
Electric locos., railway	114	+ 61
Station and warehouse electric motor trucks	162	+ 7
Starting and controlling equipment for industrial motors	1,168	+ 345
Starting and controlling equipment for electric railway and vehicle motors	751	+ 548
Portable electric tools	910	− 39
Accessories and parts for motors	1,660	+ 230
Household electric refrigerators	11,740	+ 2,386
Commercial electric refrigerators up to 1 ton	2,232	+ 256
Electric fans	548	+ 189
Lamps for automobiles, flash-lights and Christmas trees	357	+ 129
Other metal filament lamps	826	+ 86
Other electric lamps	141	+ 47
Electric household washing machines	1,066	+ 512
Electric domestic vacuum cleaners	510	+ 176
Other domestic motor-driven devices except tools	633	+ 199
Electric flat irons	225	+ 46
Electric cooking ranges, domestic	365	+ 96
Other electric heating and cooking devices	639	+ 176
Industrial electric furnaces, ovens and other heating devices	616	+ 218
Therapeutic and X-ray apparatus	1,474	+ 58
Radio transmitting sets, tubes and parts	1,817	+ 239
Receiving sets	16,041	+ 569
Radio receiving tubes	3,514	+ 631
Receiving set components	5,660	+ 1,086
Loud speakers	706	+ 247
Other receiving set accessories	540	+ 50
Telegraph apparatus	227	+ 47
Telephone instruments	186	− 53
Other telephone equipment	1,841	+ 157
Bells, buzzers and alarms	199	+ 49
Starting, lighting and ignition equipment	1,317	+ 94
Insulating material	347	+ 50
Metal conduit, outlet and switch boxes	625	+ 85
Sockets, outlets, fuse blocks and lighting switches	775	− 40
Electric interior lighting fixtures	1,056	+ 350
Electric exterior lighting fixtures	167	− 7
Other wiring supplies and line material	737	+ 74
Other electrical apparatus	5,777	+ 846
Insulated iron or steel wire and cable	49	+ 21
Rubber-covered copper wire	1,105	+ 275
Telephone cable	54	− 5
Other insulated copper wire	859	+ 82

Business and Industrial Notes

The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

Electrical Instrument Works Extensions

Considerable extensions have recently been made to the works in Silk Street, Salford, of Salford Electrical Instruments, Ltd., one of the subsidiary companies of the General Electric Co., Ltd. In common with all G.E.C. works, that of Salford Electrical Instruments, Ltd., is self-contained, the products being manufactured in the works from raw materials, with the exception of such requirements as cable, wire, mouldings, &c., which are supplied by other G.E.C. works. The main lines of manufacture include ammeters, voltmeters, wattmeters, tachometers, thermometers, thermostats, circuit-breakers, protective devices, cinema projectors, photo-cells, relays, loading coils, mercury switches and laboratory apparatus. It is of interest to note that the original Peel works, the forerunner of the present Salford Instruments works, can claim to be the cradle of the manufacturing activities of the General Electric Co., Ltd., having been founded as the G.E.C. main works in 1893, when it housed all the company's productive departments. By 1901 the Peel works were found to be too small for these departments, and the large site now representing the Witton works of the company was acquired, and the motor switchgear and other productions were transferred to it, leaving at Salford the telephone, meter and the arc lamp departments. In 1925 the telephone interests were moved to Coventry. The meter department of the company, after a brief tenure of other premises as a separate concern, then took possession of the Peel works to concentrate upon the activities which it now embraces. Ten years later, further extensions being necessary, an adjacent factory, the Rigby works, on the same island site, was acquired. Even this was found to be insufficient for accommodation, and the factory has accordingly been rebuilt into a two-storey building (the main works are of six storeys) with facilities for extending it one or two storeys higher. It is this building, on the site of the old Rigby works, which was officially opened by the Mayor of Salford, Councillor P. Ashcroft, a few days ago, and it was stated at the ceremony that not only is the extension of these particular premises contemplated in the near future, but also that the Crescent mills, the next block along Silk Street, which have been purchased by the company, will be brought into use at an early date. At present the floor area of the factory is 160,000 sq. ft., while approximately 850 people are employed.

One of the machine shops of Salford Electrical Instruments

Film Enterprise at Ilford

Under the auspices of the Ilford Electricity Department (borough electrical engineer, Mr. G. F. Gregory) a short film has been included in the programme of two of the leading cinemas of the borough during the past fortnight. In something like three minutes the audience is introduced to a number of applications of electricity in the home and beyond. The film commences with a view of Ilford's central showrooms, accompanied by an appropriate message; it goes on to an ill-lighted domestic interior, complete with a family, to show what need not be endured with electricity at hand. Then there is a glimpse of a kitchen equipped with refrigerator, cooker, &c., and "shots" showing an electric vacuum cleaner and washing machine in action. The commercial aspect is illustrated by a section showing an electric vehicle for trade purposes, and the great improvement in street lighting brought about by electric-discharge lamps is effectively demonstrated in another section.

Vacuum Cleaner Works Fire

Temporary power mains were connected at the Cricklewood works of Vactric, Ltd., on May 6th, and production was resumed on regular schedule despite the fire which swept through the factory early in the previous day. Damage from the blaze was confined to the offices and armature-winding department. None of the machinery or completed stock of the vacuum cleaner works was destroyed by the conflagration. Temporary offices have been established by the management so that business can be conducted as usual. The Sales Department is now at 10, Vivian Mansions Avenue, Hendon, N.W.4 (telephone: Hendon 6742); the Service Department is temporarily at Westmoreland Road, Queensbury, N.W.9 (telephone: Colindale 6016); and the secretary's and general offices are at 7, Park Lane, W.1 (telephone: Mayfair 5385). Negotiations are under way for approximately 5,000 sq. ft. of office space to be used until the débris caused by the blaze has been cleaned up and a re-orientation of the departments completed. The fire was confined chiefly to the offices and the front roof of the works structure.

E.D.A. (North-Western Area)

The North-Western Area of the British Electrical Development Association held its quarterly meeting at Southport on May 6th, when about 200 delegates were entertained by the Corporation Electricity Committee. The visitors were welcomed by the Mayor of Southport (Councillor H. W. Barber), who is also branch manager for Johnson & Phillips, Ltd., in the Manchester area. Supporting the Mayor were Councillor G. Sherrington (vice-chairman of the Southport Electricity Committee), Mr. W. T. Gann (borough electrical engineer), and Mr. J. Ratcliffe (electrical engineer to the Whitworth U.D.C.). Mr. G. E. Smith, of Barrow-in-Furness, presided.

Members of the North-Western Area of E.D.A. at their quarterly meeting at Southport

The Mayor, in welcoming the delegates, stressed the fact that it paid to specialise in particular sales campaigns at different seasons of the year instead of carrying out spasmodic selling. In Southport they were leading the way during the Coronation period by installing electric fountains and illuminating the pier and Marine Bridge. Times were much better than they were two or three years ago, and with the increasing purchasing power of the people they could look forward with more hope to the future. Mr. G. E. Smith proposed a vote of thanks to the Mayor for being present.

E.C.A. (Manchester Branch)

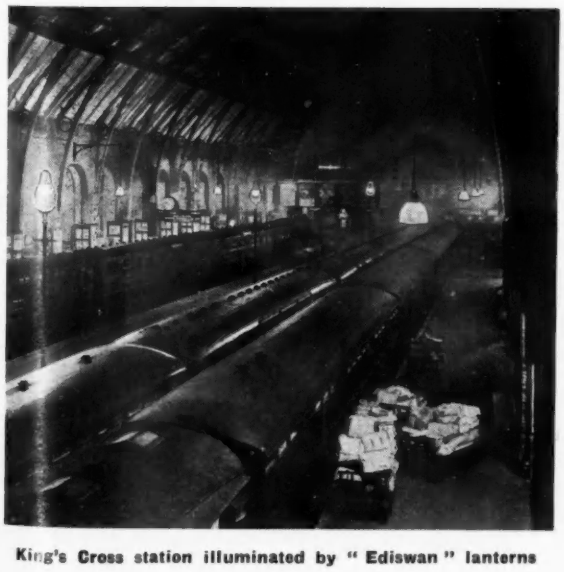
The annual meeting of the Manchester Branch of the Electrical Contractors Association was held in Manchester on May 4th, when Mr. L. C. Penwill, director and secretary, reviewed the Association's progress and indicated the lines of development. He pointed to the great purchasing power of members of the organisation and expressed the hope there would be a good attendance at the annual conference to be held at Blackpool. Mr. L. E. Wilson was re-elected Branch chairman. Owing to the resignation of Mr. A. T. Barratt from the vice-chairmanship Mr. S. Dickinson was elected his successor.

The Training of Engineers

The annual dinner of the Bradford Engineering Society was held on May 7th at the Victoria Hotel, Bradford. The chief guest was Mr. Frank Parkinson who, in proposing the toast of "The Bradford Engineering Society," said that his many visits to the United States had convinced him that the calibre of our engineers was equal in every respect to that of corresponding young men in America. He had formed the opinion that the technical training and the wider experience possible gave the American engineer definite advantage over us. He would like to see the technical training of our young engineers improved, as he was convinced that the future would require still higher standards of training.

New Lighting at King's Cross Station

A new system of platform lighting utilising fittings supplied by the Edison Swan Electric Co., Ltd., has been installed at King's Cross Station, N. The usual dismal tunnel-like effect obtained when the total output of the lighting fittings is concentrated on the platforms has been avoided by permitting a percentage of the light rays to rise above the horizontal and illuminate the roof of the station. Not only does this new practice make the station more cheerful, but it also gives it a more spacious appearance. Special "Ediswan" enclosing globe lanterns having opal sides and etched bases are employed. In addition to passing light for the illumination of the roof, the opal sides act as partial reflectors directing a substantial portion of the light downwards, through the

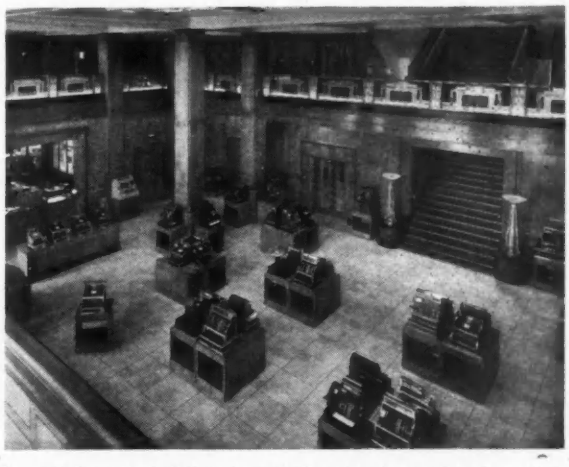


King's Cross station illuminated by "Ediswan" lanterns

etched base, on to the platform. Lamp replacement and cleaning have been facilitated by connecting the globe to its housing by means of an elbow jointed extension piece. The globe is, therefore, still connected to its housing even when the lantern is opened.

Modern Office Lighting

An excellent example of the way in which electric lighting is employed in up-to-date offices is to be found at the new headquarters of the National Cash Register Co., Ltd., at 206, Marylebone Road, London, N.W.1. The main showroom is lighted by a laylight and luminous balustrade around the gallery, and in certain internal rooms artificial illuminated windows have been incorporated. Throughout the various rooms direct and indirect lighting schemes have been employed. The main façade of the building is floodlighted, while the main ground-floor show windows are well equipped with lighting points to permit any decorative feature required. For an emergency or standby supply for lighting purposes a Chloride "Keepalite" system is provided, and special arrangements have been made to allow it to be employed by the night watchman as a pilot service. The whole of the motive power for the boiler house, air-conditioning plant and works sections of the building is supplied by electric motors arranged with automatic push-button control. The company's cash registers and accounting machines are sold all over the country



An efficient laylighting installation in the main showroom at the new head offices of the National Cash Register Co., Ltd.

under greatly varying conditions of electricity supply. Therefore motor generators and transformers have been installed, supplying various a.c. and d.c. voltages, to enable testing to be carried out under actual working conditions after delivery. For the electro-plating, electro-typing, nickel-plating and cleaning processes necessary for the works four rectifiers have been installed, having outputs of 100 to 500 A at 3 to 6 V. The electrical contractors were the Berkeley Electrical Engineering Co., Ltd., Mr. J. Stinton Jones being the consulting engineer. Among those who supplied electrical equipment were: Waygood Otis, Ltd. (lifts); Instanta Electric, Ltd. (clocks); Duncan Watson, Ltd., and Troughton & Young, Ltd. (lighting fittings); Reliance Telephones, Ltd. (house telephones); and Haywards, Ltd. (lantern lights).

Willing's Press Guide

The 1937 edition of Willing's Press Guide (Willing Service, 2s. 6d. net), which has just been published, forms a useful directory of newspapers and periodicals published in London, the provinces, the Dominions and foreign countries. Arranged alphabetically, particulars are given of annual subscription rates and the names and addresses of the proprietors. In addition to the alphabetical list, the provincial publications are arranged under counties and towns and there is also a directory of reporting and news agencies.

Recent Contract

Marryat & Scott, Ltd., have received the contract for the installation of six lifts at St. Dunstan's Convalescent Home, Brighton. The work is to be done under the direction of Sir John Burnet Tait & Lorne, architects, and will be specially designed for the safe conveyance of and for use by blind persons.

A New Lamp

According to the *Financial Times* the American General Electric Company and the Westinghouse Electric and Manufacturing Company have perfected a new high efficiency tungsten filament which increases the light output of incandescent lamps by 10 per cent. without using any additional current.

Prices of Materials

Messrs. Henry Gardner & Co. report, May 11th: Copper bars (best selected), sheet and rod, £95, £2 increase. Spelter, £23 3s. 9d., 13s. 9d. decrease. English block tin, £249 5s., £3 5s. decrease. No change in the price of English pig lead.

Messrs. Edward Till & Co. report, May 11th: No change in the price of India rubber, Para fine.

For Sale

The Glasgow and West of Scotland Convalescent Seaside Homes, Dunoon, has generating plant for sale.

(See our classified advertisements.)

A Floodlighting Catalogue

A new publication entitled "Floodlights and Floodlighting" has been issued by the General Electric Co., Ltd. This deals exhaustively with the illumination of various types of build-

ings, gardens, lakes, &c., and embraces every class of floodlighting. It is profusely illustrated showing installations in which G.E.C. equipment has been used (some of the pictures are in colour) and includes particulars of the company's floodlighting equipment.

New Crompton Lamp Factory

The accompanying picture shows the new lamp factory which is being erected at Guiseley, Leeds, for Crompton Parkinson, Ltd. It has five floors and, it is claimed, will be one of the largest lamp factories in the world. The company expects the building to be completed before the end of the current year—in time for the 1937-38 lighting season.

The West Midlands J.E.A.

Mr. G. R. J. Parkinson, retiring chairman of the West Midlands Joint Electricity Authority, was the principal guest at a luncheon in his honour on May 7th at the Victoria Hotel, Wolverhampton. Mr. Parkinson was presented with a framed resolution embossed on vellum expressing admiration and appreciation of his work. Councillor H. Southan, chairman of the authority who made the presentation, said the output had increased from 310,000,000 kWh to 545,000,000 kWh since Mr. Parkinson had become associated with the authority. Coal consumed per kWh had decreased from 2.05 lb. to 1.60 lb., and the total cost per kWh generated was 0.31d., as against 0.363d. Revenue from sales had increased from £464,000 to £703,000 and capital expenditure sanctioned had totalled £1,250,000. In response, Mr. Parkinson said that in some small areas there was room for improvement in distribution, but he hoped that in districts where individual undertakings or groups were operating efficiently they would be allowed to carry on their work. The Mayor of Wolverhampton, Sir Charles Mander, and Mr. Cliff Tibbets, of Walsall, were other speakers. Mr. Tibbets said it was twenty-one years since the original Committee met, and nearly twelve years since the Authority commenced operation.

Charges Under the Companies Act

At Nelson on May 4th three men were proceeded against for offences under the Companies Act in connection with the affairs of the Commercial Engineering Co., now being wound up. The accused were Jack S. Gorman (23), Burnley; Hugh Thornton (40), Nottingham; and Charles Hodge (48), Nottingham, who were summoned for failing to keep proper books of account, while Gorman and Thornton were summoned for carrying on the business of the company with intent to defraud. Gorman, in addition, answered a charge of obtaining goods on credit by false representation.

Mr. R. A. Etherington, area supervisor for Philips Lamps, Ltd., Manchester, spoke to receiving orders from the Commercial Engineering Co. for which payment was not made. The imposing notepaper impressed him. Mr. H. Shawcross, prosecuting, said it was alleged that defendants were engaged in a carefully-thought-out system to exploit company law to further their fraudulent ends. With a man trading on his own account, or as a partner, he remained personally liable, but with a limited company he avoided personal liability, the company alone being responsible. It sometimes happened that creditors were left with no effective remedy, and proper books were one of the issues in this case. Defendants, he alleged, deliberately set out to make use of this company, which was formed in January, 1935, with an authorised capital of 400 shares of 5s. each.

Defending counsel contended there was no case to answer, and said the charges could not be substantiated. Defendants were not directors of the company, and there was no evidence to connect Thornton with the concern. Counsel for Gorman submitted that no jury would convict on the evidence against him. There were pleas of "Not guilty," and after two days' hearing accused were committed for trial at Manchester Assizes, bail being allowed.

Coronation Concessions

The directors of Lancashire Dynamo & Crypto, Ltd., in addition to paying full wages to the works employés on the occasion of the Coronation holiday, have granted a bonus payment to all hourly paid employés who have been continuously with the company since June 30th, 1936.

New Catalogues and Lists

Normand Electrical Co., Ltd., North Street, Clapham Common, S.W.4.—A humorously written booklet ("Neco's Unhelpful Book") about electric motors.

Hewittic Electric Co., Ltd., Walton-on-Thames.—A leaflet illustrating glass-bulb rectifiers.

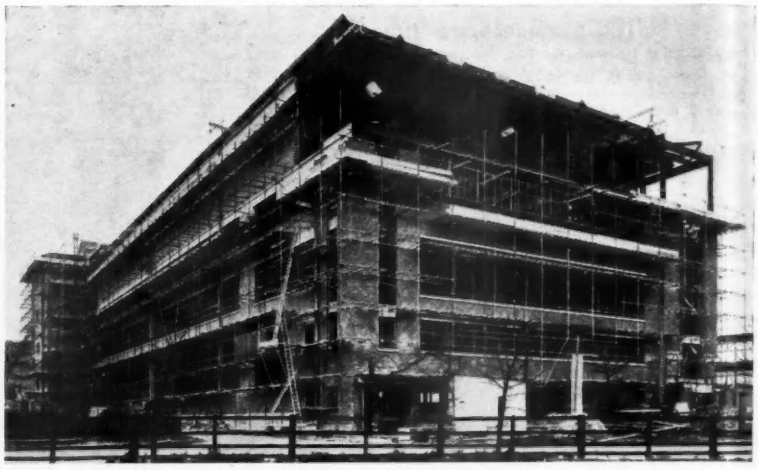
Frigidaire, Ltd., The Hyde, Hendon.—Catalogues of refrigeration equipment, including milk bars, milk coolers, ice-cream equipment, and equipment for hotels and restaurants.

General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.—Full technical details of 80- and 125-W electric-discharge lamps. Also an abridged price-list of iron-clad switchgear.

Hackbridge Electric Construction Co., Ltd., Walton-on-Thames.—An illustrated leaflet dealing with large transformers.

British Insulated Cables, Ltd., Prescot.—Jointing compounds, motor-car cables, copper sections and sheets, bell wires, paper pinions, clear insulating varnishes, window lead sections, aluminium sheet and matting, earthing rods, lightning conductors and wiring systems are dealt with in a number of new coloured catalogues.

Benjamin Electric, Ltd., Brantwood Works, Tariff Road, Tottenham, N.17.—Details of the "Ile" reflector for petrol pumps and a booklet dealing with the commercial application of electric-discharge lighting.



The new lamp factory which Crompton Parkinson, Ltd., are erecting at Guiseley, Leeds

Higgs Motors, Ltd., Witton, Birmingham, 6.—D.c. motors (protected, screen-protected and drip-proof), gear units and totally enclosed polishing and grinding motors are the subjects of three new publications.

Crompton Parkinson, Ltd., Bush House, Aldwych, London, W.C.2.—The latest price-list of electric lamps contains an announcement to the effect that the company has now joined the E.L.M.A.

Batteries, Ltd., Hunt End Works, Redditch.—A booklet dealing with "Nife" nickel-cadmium alkaline batteries for aircraft.

Wholesale Fittings Co., Ltd., 23-27, Commercial Street, London, E.1.—A 128-page illustrated art catalogue of electric lighting fittings.

Bankruptcy Proceedings

J. R. Brightwell, electrical contractor, 107, Queen's Road, W.—The public examination was held on May 5th before Mr. Registrar Kean at the London Bankruptcy Court. The debtor failed on March 22nd last with liabilities of £1,242, against net assets of £353. He stated that in 1897 with £800 capital he started trading as an electrical engineer and was successful until 1927. He then formed a limited company and transferred his business to that company and acted as a director at a salary of £500 a year. After 1930 the company suffered from the slump in trade and in February, 1935, the concern went into voluntary liquidation. In the same month debtor purchased the stock from the liquidator and started business again. For a year the trade was profitable, but afterwards there was a considerable decline, and eventually when judgment was obtained against him the present proceedings ensued. Debtor attributed his failure to his neglect properly to supervise the accountancy part of the business, trade depression, heavy overhead expenses, and lack of capital. The examination was closed.

B. H. Auld, electrical engineer, 66, Victoria Street, London, S.W.—The public examination of this debtor was held on May 5th at the London Bankruptcy Court, before Mr. Registrar Kean. Debtor failed on March 18th last with liabilities of £2,495 and assets of £2,587, or a surplus of £92. Replying to the Official Receiver debtor said that in February, 1919, with a capital of £1,000, he commenced trading as an electrical engineer under the style of Bruce H. Auld & Co. He carried out successfully many engineering contracts for municipal corporations and industrial concerns. Recently, however, he exhausted all his capital and judgment was eventually obtained against him. He attributed his failure to heavy expenditure in the development of plant and equipment and to delay in receiving money owing to him. The examination was closed.

N. Hall, wholesale and retail radio dealer, 66, Margaret Street, Ashton-under-Lyne, trading as Hall & Co., and also at 278, Stamford Street, Ashton-under-Lyne, under the style of Horners.—This debtor attended at the Town Hall, Ashton-under-Lyne, recently, for his public examination. The statement of affairs disclosed gross liabilities of £2,986, of which £2,186 was expected to rank for dividend. The assets were expected to produce £1,196. The debtor attributed his failure to lack of capital. The examination was adjourned.

H. E. Smith, High Street, Limpsfield, Surrey, radio and electrical engineer.—The public examination herein was held at the County Court, Scarbrook Road, Croydon, recently. Debtor said his failure was due to lack of capital and insufficient profits, adding that the business was situated in the wrong neighbourhood. He gave as a contributory cause his inexperience of the trade. His statement of affairs showed a deficiency of £478. The examination was adjourned for closing.

A. Lewsey, carrying on business as West Ewell Electrical Supplies, 2, The Parade, Chessington Road, West Ewell, Surrey, electrical and wireless engineer.—This debtor filed his own petition recently and has returned a statement of affairs showing gross liabilities of £956, of which £882 is expected to rank for dividend. There are net assets of £294, leaving a deficiency of £589. Debtor attributes his failure to insufficient profits to meet overhead charges and drawings.

A. H. Estall, electrical contractor, 20, Thackeray Street, Kensington, W.8.—Receiving order made May 3rd on debtor's own petition. First meeting May 19th and public examination June 16th, both at Bankruptcy Buildings, Carey Street, W.C.2.

W. R. Mew, wireless and electrical engineer, "Silvermere," Lushington Hill, Wootton, I. of W.—First meeting May 14th at 87, High Street, Portsmouth. Public examination June 16th at the Town Hall, Newport, I. of W.

J. Lazarus and **M. Lazarus** (Langdons Radio), wireless and electrical dealers, 217, Golders Green Road, Golders Green, N.W. (separate application of M. Lazarus).—Application for discharge to be heard on June 4th at Bankruptcy Buildings, Carey Street, W.C.2.

K. F. Butcher, formerly carrying on business as Radiolectric Co., at 24, Well Hall Road, Eltham, S.E.9, and now residing at 157, Hook Lane, Welling, Kent.—Trustee, Mr. L. A. West, Bankruptcy Buildings, Carey Street, W.C.2, Senior Official Receiver, released April 28th.

G. W. Linsell, radio and electrical dealer, Tippendale Lane, Park Street, near St. Albans.—First meeting May 13th at 29, Russell Square, W.C. Public examination June 23rd at the Court House, St. Albans.

J. C. De Wardt (De Wardt Radio), radio and electrical engineer, 10, Windmill Street, Gravesend.—First dividend of 9d. in the £, payable May 24th at 3, Warwick Court, Gray's Inn, W.C.1.

A. E. Baker, electrical engineer, 42, Chapel Road, Bexley Heath.—Receiving order made May 4th on debtor's own petition.

Company Liquidations

Reid Productions, Ltd., 58-62, Pitfield Street, W.—The statutory first meetings of creditors and shareholders under the compulsory liquidation of this company were held on May 7th at the Board of Trade Offices, Carey Street, W.C., before Mr. H. P. Naunton, Senior Assistant Official Receiver. The company was registered in July, 1936, with a capital of £500, the main object being to manufacture radio receivers of a new type—a four-programme pre-tuned receiver—for sale to relay exchanges. A certain number were manufactured and sold to relay companies, but owing to delay in completing arrangements for the necessary hire-purchase finance the company was unable to sell the number of receivers it had anticipated nor was it able to take delivery of the components under a contract into which it had entered. On February 25th, 1937, the company was served with a demand for payment of £3,700 for moneys advanced. The directors endeavoured to come to an arrangement for the settlement of this debt, but they were unsuccessful and the winding-up order was made on April 12th upon the creditors' petition. The liabilities are returned at £4,494 and the assets are valued at £130. The failure of the company is attributed to delay in arriving at satisfactory terms regarding the selling of the company's receivers and to over-buying, also to lack of capital and to the unexpected demand for the return of moneys by the loan creditors. The liquidation was left in the hands of the Official Receiver.

Ive & Murdoch, Ltd., electricians, &c., Littlestone and Dymchurch.—Under the compulsory liquidation of this company, which carried on business at The Avenue, Littlestone and High Street, Dymchurch, the accounts show liabilities of £1,644 against assets of £894, issued capital £1,000, and a total deficiency of £1,749. Mr. J. Barwick Thompson, Official Receiver, reports that the company was formed in November, 1935, to take over as a going concern the assets and business of electricians, radio and electrical dealers of the Littlestone and Dymchurch branches of L. J. Ive, Ltd. The purchase consideration was agreed at £1,705 in cash and bills which were duly honoured. The revenue received by the company appears to have been used mainly to meet the bills (£705) given as part of the purchase consideration, causing a lack of ready cash with which to meet the claims of the trade creditors who in May, 1936, began to press for payment. Two creditors levied executions in January last and a third presented the petition upon which the winding-up order was made. The failure of the company was attributed chiefly to lack of capital and declining volume of business in the district. Mr. A. J. Osborne, accountant, has been appointed liquidator, with a committee of inspection.

Dorman & Smith, Ltd.—Winding up voluntarily for reconstruction purposes. Liquidator, Mr. H. Terras, 64, Cross Street, Manchester, 2. The company has entered into an agreement for the sale of its assets to a successor company registered in the name of Dorman and Smith (1937), Ltd. The business will be carried on by the new company as heretofore at Ordsal Electrical Works, and the present directors will continue to act on the board of the new company.

Bishop Radio Stores, Ltd.—Winding up voluntarily. Liquidator, Mr. W. S. F. Stagg, 128, Romford Road, Stratford, E.15.

Private Arrangements

W. R. Brooker, trading as Everymans Radio Service, 8a, Watford Way, Hendon Central, London.—The creditors herein met recently, when the statement of affairs showed liabilities of £364, all due to the trade. In addition there were loan creditors for £850, but those amounts had not been included in the ranking liabilities. The net assets were £106, leaving a deficiency of £258. It was decided that the meeting should be adjourned to enable the debtor to approach friends with a view to paying a composition of from 7s. 6d. to 10s. in the £.

Dissolution of Partnership

J. A. Baker, electrical engineers, 35, Newland, Northampton.—Messrs. G. W., J. A. H., and H. H. Baker have dissolved partnership so far as concerns G. W. Baker. Messrs. J. A. H. Baker and H. H. Baker will attend to debts and carry on the business.

Electricity Supply

Lighting, Domestic, Power

Birtley.—PUBLIC LIGHTING.—The Council has received permission to raise a loan of not exceeding £2,000 for the provision of public lighting.

Blackburn.—STREET LIGHTING.—A proposed new road from Preston Old Road to Hollin Bridge Street is to be lighted by means of twenty-eight mercury electric-discharge lamps, at an estimated cost of £816.

SUB-STATION.—A supply of electricity to Oozebooth Mill necessitating a new sub-station and an extension of the 6,600-V main is to be given at a cost of £1,345.

Bolton.—POWER STATION EXTENSION.—Speaking at a meeting of the Town Council last week the chairman of the Electricity Committee recalled that twelve months ago he had endeavoured to allay fears that the Back-o'-th'-Bank power station would eventually be closed down. The Central Electricity Board, he said, had now agreed to the station being extended by the addition of a 30,000-kW turbo-generator and the requisite steam-raising plant. The cost would be about £300,000.

Bridge-Blean.—INSISTENCE ON UNDERGROUND CABLES.—Consideration has recently been given by the Housing and General Purposes Committee of the Rural District Council to a proposal of the South-East Kent Electric Power Co., to erect overhead lines at Bridge and Barham. At the recent meeting of the Council it was decided to insist on underground cables.

Belgium.—ELECTRIC-DISCHARGE LIGHTING.—The installation of electric lighting along the road between Brussels and Antwerp is one of the most important schemes of this type to be carried out on the Continent. It covers twenty-five miles of highway and includes not only built-up areas but also the sections of the road in the open country, the purpose being to determine the advantage to traffic of lighting a heavily-trafficked thoroughfare. For this reason the installation is designed on somewhat experimental lines. Both sodium and mercury electric-discharge lamps are used, the former being mostly in the open country and the latter in the built-up areas in order to avoid the colour changes which monochromatic light would bring about in towns. Wherever possible, existing standards have been adapted to the new lighting. The standards vary in height, according to the section of the road, between 26 and 32 ft., and are spaced from 50 to 100 ft. In some places the lamps are all on one side of the road and in others they are staggered on opposite sides. In two instances mercury lamps are strung from supporting cables across the streets. The whole installation, comprising 752 sodium and 806 mercury lamps, is supplied from fifteen sub-stations, armoured cables connecting the low-voltage side of each with a control box. The lamps are fed from the control boxes by overhead wires, an exception being on the boulevard outside Malines, where underground cables are used. The lamp reflectors are designed so that glare is practically eliminated. The cost of the installation amounted to about £1,100 per mile. Two illustrations appear on the next page.

Canada.—PROPOSED QUEBEC COMMISSION.—A *Reuter* message from Quebec states that the Bill providing for the creation of an Electricity Commission introduced into the Legislative Assembly by Mr. Duplessis, Premier of Quebec, has passed its third reading. It has now been sent forward to the Legislative Council. The Bill provides for powers to revise contracts and fix the rates of all private power companies in the Province.

Cannock.—LOAN.—Application is to be made by the Urban District Council for sanction to a loan of £1,750 for the erection and equipment of a new meter testing department.

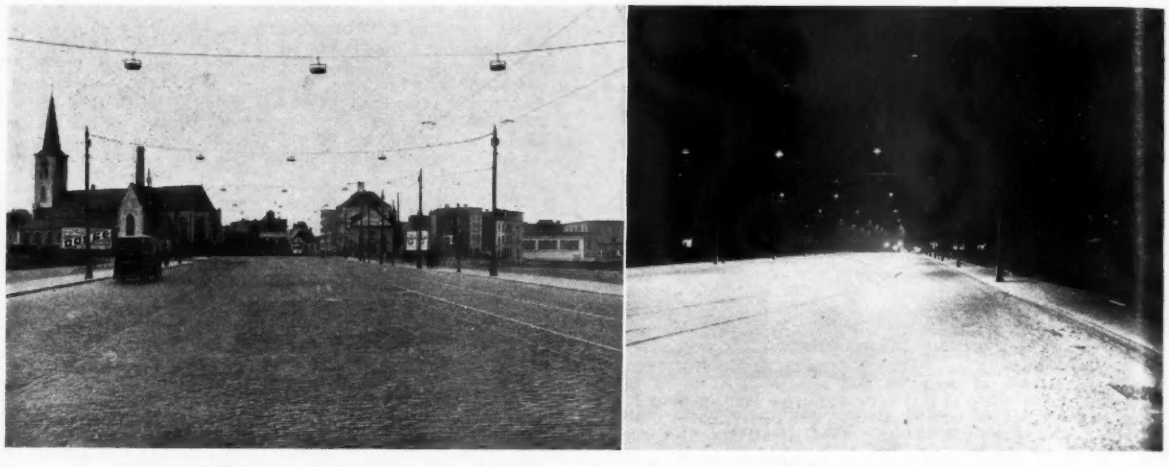
Cardiff.—SUPPLY SCHEME HELD UP.—A proposal of the Electricity Committee of the Rural District Council for making supplies of electricity available at Llancarfan, Fonmon, Penmark and Bonvilston was debated at a recent meeting of the Council. It was stated that the total number of prospective consumers was 140, representing an annual revenue of £560. The estimated capital cost of the scheme was £6,086, and the residents were prepared to pay 6d. per kWh for the time being in order to obtain a supply. A member described the scheme as a revolutionary departure from the policy of the Council. Unless it had a reasonable chance of being a financial success he was not prepared to give his approval. Similar proposals in regard to Rhiwbina had been rejected because it was thought they would not show a profit. Another member said that electricity should be regarded as a public service and not merely as a profit-making concern. It was decided to refer the matter back to the Electricity Committee.

Ceylon.—A report from our Bombay correspondent states that, according to Major Brazel, chief electrical engineer, Government electricity undertakings, electricity generated during the past year amounted to 20,003,000 kWh, an increase of over 17 per cent. on the previous year, while the combined station peak load of 5,495 kW was 10 per cent. above the previous highest peak load. As a result of financial reorganisation there was a reduction of more than 9 per cent. in the total cost of operation per kWh sold. The gross profits amounted to 7.5 per cent. of the capital valuation, which is regarded as very satisfactory. In addition, there are thirty-two undertakings operated by municipalities, with 4,250 kW of plant installed and an output of 4,000,000 kWh, while plans

and specifications have been prepared for twelve new schemes and extensions of those already in operation.

Chanctonbury.—Overhead Lines.—No objection is being raised by the Rural District Council to the Steyning Electricity Co. erecting high-voltage overhead lines to the proposed pumping station at Washington, nor to the company placing a low-voltage overhead line along Mill Lane and part of Rectory Lane, Ashington. A similar attitude is taken in regard to Central Sussex Electricity, Ltd., extending its low-voltage mains along George's Lane, Washington.

Dover.—Change-over.—The borough electrical engineer reports that a number of districts have been changed over during April and only two sections remain.



Street lighting at Berchem, between Antwerp and Brussels (see note under "Belgium" page 741)

Dumfries.—Loans.—The Electricity Committee is applying for sanction to borrow £3,000 for meters; £5,000 for hired appliances; £3,000 for sub-station equipment; and £5,000 for unspecified mains and services.

Dumfries-shire.—Extension of Area.—At its meeting last week the County Council decided to apply to the Electricity Commissioners for an extension of its area of supply to include Castleton, Roxburghshire. This follows upon the destruction by fire of the generating station of the Newcastleton Electric Supply Co. The Roxburgh County Council has consented to the proposal.

Eccles.—Loans.—Sanction to borrow £20,000 for mains and services; £970 for a sub-station and £3,812 for sub-station equipment is being sought by the Electricity Committee. It is proposed to raise a loan of £2,191 for alterations to the installations in houses on the Westwood Park estate.

Street Lighting.—Extensions are to be carried out to the "Osira" electric-discharge street lighting at a cost of £2,388.

Fareham.—Sub-station.—The Urban District Council proposes to purchase a sub-station site at Gudgeheath Lane.

Heston and Isleworth.—Possible Power Station Extension.—The agreement under which the Metropolitan Electric Supply Co., Ltd., furnishes electricity in bulk to the Council expires at the end of next year, and the Electricity Committee has given consideration to the arrangements to be made for meeting its requirements after then. In a report on the matter the borough electrical engineer (Mr. S. H. Fowles) sets out the comparative costs of (1) the undertaking taking a bulk supply to meet the whole of its requirements; (2) continuing to take a bulk supply to meet the major part of its needs and generating the remainder itself; and (3) generating the whole of its requirements. The figures show that a considerable annual saving would result from the adoption of the last method. The engineer has also prepared a report on the estimated increase in the demand on the undertaking during the five years from 1938 to 1943, and the plant necessary to meet it. This shows that extension of the generating station buildings will be required to accommodate the additional plant, and cooling towers will have to be erected. The Electricity Committee feels that the generation by the Council of the whole of its requirements would result in a cheaper supply to consumers, but it is anxious that the scheme should be fully investigated, and proposes to engage a consultant.

Hull.—Sale of Steam.—The Cleansing Committee is to discuss with the Electricity Committee a proposal to erect a Volund steam-raising refuse disposal plant at a cost of £148,500 and to sell the steam raised to the Electricity Department for the generation of electricity.

Assisted Wiring.—The Electricity Committee is seeking sanction to borrow £25,000 for assisted wiring.

Electric Heating.—A scheme for electric heating and domestic hot water supply in connection with the proposed isolation cubicle block at the institution has been approved by the Health Committee.

India.—Mysore.—The report of the Electricity Department for 1935-36 records good progress. At the end of the year there were 3,472 power installations against 3,123 a year before. Energy generated amounted to 208,332,440 kWh against 200,754,040 kWh.

Irish Free State.—Monaghan.—The undertaking of the local electricity company has been acquired by the Electricity Supply Board.

Newtownbarry (Co. Wexford).—The Electricity Supply Board has taken over the local electric lighting company's undertaking at a figure representing 10s. per £1 share fully paid up.

Leeds.—New Switchgear.—The Finance Committee has authorised the following:—Additional feeder switchgear at Kirkstall power station, £6,000; and supplying and laying a 33,000-V cable between the Kirkstall and Whitehall Road power stations, £90,000.

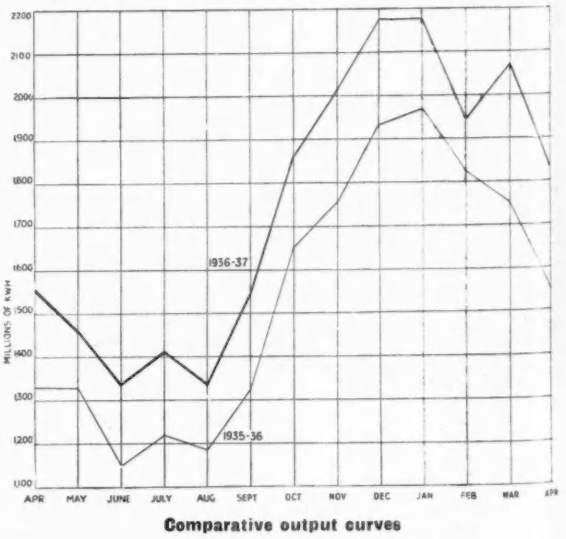
Sub-stations.—The erection of two sub-stations on the Brianside estate is to be undertaken by the Electricity Committee.

Norham (Northumberland).—Overhead Lines.—The Scottish Southern Electric Supply Co., Ltd., proposes to erect overhead lines in the Norham and Islandshires districts.

Northern Ireland.—Belfast.—Application is being made by the Electricity Committee for permission to raise loans totalling £134,264 in connection with expenditure on its transmission and distribution systems.

Generation of Electricity in April

THE official returns rendered to the Electricity Commissioners show that 1,832 million kWh of electricity was generated by authorised undertakings in Great Britain during April, as compared with the revised figure of 1,554 million kWh for the corresponding month of 1936, representing an increase of 278 million kWh, or 17.9 per cent. The number of working days in the month (*i.e.*, excluding Sundays) was 26, as against 24 last year.



Comparative output curves

During the first four months of 1937 up to the end of April the total quantity of electricity generated by authorised undertakings was 8,026 million kWh, as compared with the revised figure of 7,101 million kWh for the corresponding period of 1936, representing an increase of 925 million kWh, or 13 per cent.

Oldbury.—ELECTRICITY ON HOUSING ESTATES.—Following the receipt of a petition signed by 120 tenants on the Basons Farm estate the Housing Committee has decided to raise no objection to electricity being installed.

Plymouth.—MAINS.—The Electricity Committee is to extend mains at a cost of £3,300.

Poland.—ELECTRICITY SUPPLY PROGRESS.—The Société d'Entreprises Electriques en Pologne, of Brussels, in its report for last year, states that the sales of power by its affiliated undertakings in Poland during 1936 showed an increase of 23 per cent. over the previous year. The load on the power stations increased from 48,653 to 53,166 kW, and the number of consumers to 71,745. Additional plant is being installed at the power stations at Czestochowa and Bialystok.

Poole.—STREET LIGHTING.—In accordance with a resolution of the Town Council the Roads and Works Committee recently re-examined its recommendations with regard to street lighting, but did not alter its views, namely, that the tenders of the Bournemouth & Poole Electricity Supply Co. for lighting the classified roads and of the Bournemouth Gas & Water Co. for lighting other roads should be accepted. The matter came before the Town Council again last week, when the recommendations were approved after an amendment for all-gas lighting had been rejected.

Rothbury (Northumberland).—STREET LIGHTING.—The Council has obtained sanction to borrow £842 for electric street lighting.

Scarborough.—SUB-STATION.—The Town Council is making application to the Electricity Commissioners for sanction to borrow £2,541 for a new sub-station at Wheatcroft.

Sheffield.—LOANS SANCTIONED.—The Electricity Committee has obtained sanction to borrow £179,625 for buildings and cooling tower superstructure plant, £15,870 for mains and £14,908 for sub-station equipment.

SUB-STATIONS.—Direct labour is to be used by the Electricity Committee for the erection of sub-stations in Sussex Street and at Parsons Cross. Expenditure involved is £682 and £1,525 respectively.

South Shields.—NEW PLANT.—Sanction has been obtained by the Electricity Committee to borrow £6,000 in connection with the installation of plant.

NEW SUB-STATIONS.—The Town Council has decided to erect sub-stations in Dean Road, at a cost, including equipment, of £1,080, and in Prince Edward Road (£761).

Stamford.—SUB-STATION AND MAINS.—Proposals of the Urban Electric Supply Co. for the erection of a sub-station and for mains extensions have been passed by the Borough Council.

Torquay.—NEW EQUIPMENT.—Approval has been given by the Electricity Committee to an estimate of £7,000 for the erection, and £3,129 for the equipment, of a testing station in Newton Abbot.

APPARATUS FOR HIRE.—Sanction is being sought by the Electricity Committee to a loan of £10,000 for the purchase of apparatus for hire.

Turkey.—ELECTRICITY SUPPLY PROGRESS.—The Société Turque d'Electricité, which undertakes the supply of electric power in the Istanbul district, reports that the output of the generating station during last year amounted to 111,168,000 kWh, as compared with 102,878,000 kWh in 1935, the number of consumers rising during the twelve months from 97,542 to 104,510.

Warrington.—TWO-PART TARIFF.—The following alternative special two-part tariff has been fixed for cinemas:—A fixed annual charge of £8 10s. per kVA of maximum demand, plus ½d. per kWh. A discount of 5 per cent. will be allowed on accounts paid within one month.

Worcester.—REVISED CHARGES.—Besides the alterations in charges which we mentioned last week, all accounts are subject to a 10 per cent. discount. Thus, under the rateable value tariff instead of the new charge being three kWh a penny the net price is 0.3d. per kWh. This large discount was introduced several years ago to give an all-round reduction as well as offering a strong inducement to settle accounts promptly.

Worthing.—LOANS.—Sanction has been obtained by the Electricity Committee to a loan of £2,446 for sub-stations, and it is seeking permission to borrow £13,535 for sub-stations and £4,834 for cables.

Communications

Great Britain.—THE ABBEY CEREMONY.—A public address system was provided to enable all the 8,000 guests at Westminster Abbey to hear the Coronation ceremony. Standard Telephones and Cables, Ltd., were responsible for the installation, which comprised five 30-W amplifiers feeding 120 moving-coil loudspeakers, each reproducing a very low intensity of sound. To avoid echoes or coupling to microphones no horns were used.

New Zealand.—WIRELESS LICENCES.—A *Reuter* message from Wellington states that a record number of wireless licences were taken out in New Zealand during the year ended March 31st last. The total number of licences in force on that date was 241,308. According to Mr. F. Jones, the Postmaster-General, 68 per cent. of homes in New Zealand have wireless receiving sets.

Russia.—ARCTIC RADIO STATIONS.—The Soviet authorities are to set up three new radio stations in the Arctic so soon as the opening of navigation on the Northern sea route permits the delivery of the necessary equipment. Of the three stations one will be situated on the southern shore of Kotel Island, one in the De Long Archipelago, and the third on Cape Chaplin, near Providence Bay.

United States.—TELEPHONY.—According to a survey recently completed by the chief statistician of the American Telephone and Telegraph Co. there were 35,028,682 telephones in operation throughout the world at January 1st, 1936. The distribution is given as follows, the figures being the percentage of the total: United States, 49.74; Germany, 9.34; Great Britain, 7.28; France, 4.11; Canada, 3.95; Japan, 3.23; Russia, 2.46; Australia, 1.52; and Spain, 0.98. The report notes that the United States had 13.69 telephones for every 100 persons, while the telephone density for Great Britain was 5.44 per 100. Telephones in the twelve largest cities in the United States totalled more than all those in the British Empire. The number of instruments in use in various capitals at the beginning of last year is stated to have been as follows: New York, 1,503,712; Greater London, 960,709; Berlin, 513,610; Paris, 422,755; Rome, 91,689; Madrid, 66,148; Copenhagen, 182,946; and Vienna, 184,840. In point of telephone development the leading cities of the world were Washington and San Francisco, which had more than one instrument for every three persons. Local and long-distance calls completed in the United States during 1935 totalled 25,000,000,000, or about 800 conversations every second during the day and night. This is equivalent to 197 calls for every adult and child in the country; elsewhere in the world the annual rate is estimated at 12.5, or less than 6½ per cent. of the frequency with which Americans use the telephone.—*Reuter's Trade Service* (New York).

Left: An elaborate illumination scheme at Selfridge's stores, Oxford Street, W.1. Right: An ornamental pylon outside Southgate tube station, one of many installations carried out for local authorities by the Northmet Co. *[Elec. Rev. photos.*

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Aldershot.—May 18th. Borough Council. Cable and meters for one year. (May 7th.)

Australia.—MELBOURNE.—June 1st. State Electricity Commission of Victoria. Magnetic separator drum, with suitable motor generator set, or alternatively, rectifier unit, and control equipment. (April 30th.)

Banbury.—May 20th. Education Committee. Electric lighting &c., at the Dashwood school, Britannia Road. Inspector of school repairs, Municipal Buildings.

Barking.—May 24th. Borough Council. Electrical installations in flats and houses in Ripple and Abbey Roads. (May 7th.)

Beckenham.—May 31st. Borough Council. Seven three-phase transformers. (April 30th.)

Blackpool.—June 8th. Electricity Department. 6.6-kV switchgear, modifications at two cubicles, and one portable oil filter plant for transformer and switch oils. (See this issue.)

Bradford.—May 17th. Transport Committee. Fifteen, forty-two and fifty-seven double-deck trolley-buses complete, or alternatively, similar numbers of (a) double-deck trolley-bus chassis complete with electrical equipment, and (b) all-metal double-deck trolley-bus bodies. Transport general manager, 11, Forster Square.

Cardiff.—May 20th. Electricity Department. One 15,000-kVA transformer and 33,000-V and other p.i. cables. (April 30th.)

Darlington.—June 5th. Corporation. 20,000-kW turbo-alternator, with condensing and other ancillary plant. (April 30th.)

Dartford.—May 29th. Borough Council. Cast-iron lamp columns, brackets and reflectors and time switches. (See this issue.)

Doncaster.—May 28th. R.D.C. Renovating the internal wiring installations in houses at Edlington. Surveyor, Nether Hall.

Dundee.—May 17th. Education Committee. Electric lighting at St. Michael's Central school. City quantity surveyor, 21, City Square.

East Retford.—May 20th. Borough Council. One h.v. testing equipment. (May 7th.)

Edmonton.—May 24th. Education Committee. Electric lighting at Eldon Road school. W. L. Brown, director and secretary, Education Offices, Brettenham Road (deposit 10s.).

Egypt.—CAIRO.—June 15th. Ministry of the Interior. Equipment for the electrification of the Zagazig drainage section. (T.Y. 31370.)*

Epsom and Ewell.—May 18th. U.D.C. Electricity Department. H.v., p.i., l.c. and double steel tape armoured cable. (May 7th.)

Falkirk.—May 17th. Town Council. Electric radiators for Blinkbonny Home. Town clerk.

Fareham.—May 27th. U.D.C. Borehole type, electrically driven centrifugal pumps, with the necessary switchgear, at the Maindell pumping station. Taylor & Wallin, 1, Saville Place, Newcastle-upon-Tyne (deposit £10).

Fife.—May 17th. County Council. Electric lighting in eighty houses at North Glencraig. C. R. Douglas & Son, surveyors, 15, East Port, Dunfermline (deposit £1 1s.).

Great Crosby.—May 31st. U.D.C. Four electrically driven centrifugal pumps of 1,850-cu. ft. per minute capacity, with ancillary plant, &c. Howard Humphreys & Sons, 17, Victoria Street, London, S.W.1 (deposit £5 5s.).

India.—SIMLA.—June 5th. Stores Department. Cable for one year. (T. 31363.)*

Irish Free State.—DUBLIN.—June 15th. Electricity Supply Board. One 10,000-kVA transformer, with on-load tap-changing equipment. (May 7th.)

Lewes.—May 21st. Town Council. Electric passenger lift at the Council Offices. C. T. Butler, borough surveyor, Town Hall (deposit £1 1s.).

Lochgelly (FIFE).—May 17th. Town Council. Electric lighting in eighty houses. J. Gentles & Son, surveyors, Central Chambers, Kirkcaldy (deposit £1 1s.).

London.—ST. MARYLEBONE.—May 25th. Borough Council. 11-kV metal-clad switchgear. (May 7th.)

Middlesbrough.—May 21st. Fire Brigade Committee. Electrical work at new fire station and firemen's quarters, Park Road South. (See this issue.)

Morecambe and Heysham.—May 24th. Borough Council. Decorative illuminations at the super swimming stadium. (April 30th.)

New Zealand.—WELLINGTON.—June 14th. Post and Telegraph Department. Insulated copper wire. (T.Y. 31349.)*
June 22nd. Telephone cords. (T. 31368.)*
July 6th. Public Works Department. 110-kV and 66-kV outdoor switchgear and steelwork. (T.Y. 31347.)*
July 13th. Electrical testing equipment. (T.Y. 31355.)*

Northern Ireland.—BELFAST.—May 18th. Electricity Committee. Electrically driven centrifugal drainage pump and pipework; static transformers, switchgear and interconnecting cables, mercury arc rectifier equipment, and construction of sub-station building. (April 30th.)

Norwich.—Committee of Visitors of the St. Andrew's Hospital. Automatic telephone equipment. (May 7th.)

Nottingham.—June 8th. Electricity Committee. General stores for twelve months. (See this issue.)

Plymouth.—May 15th. Corporation. Conversion to a.c. of a 5-h.p. d.c. goods lift. (April 30th.)
May 19th. H.v. underground pilot cables. (May 7th.)
May 29th. Electrically operated jib cranes. (April 30th.)

Reigate.—May 20th. Borough Council. Four 400-kVA and two 300-kVA transformers. (May 7th.)

Sheffield.—May 15th. Electricity Committee. Coal-handling plant. (April 30th.)

Shropshire.—May 31st. County Council. Electric power plant, comprising transformer and four motors (aggregating 132 h.p.), lighting, &c., at the Council's quarry, Nills Hill, Pontesbury. W. H. Butler, county surveyor, County Buildings, Shrewsbury (deposit £2).

South Africa.—JOHANNESBURG.—June 19th. City Council. Electric lamps for twelve months, including lamps for street lighting. (T. 31343.)*
June 12th. Street lighting lanterns. (T.Y. 31365.)*
PRETORIA.—May 21st. Public Works Department. 200-kVA transformers, l.v. switchgear and cable. (T.Y. 31333.)*

Southampton.—May 18th. Electricity Department. Coal storage handling plant. (April 30th.)
May 24th. One 15,000-kVA, one 5,000-kVA and one 7,500-kVA transformers, switch kiosk and 33-kV switchgear. (See this issue.)

Swindon.—May 28th. Electricity Department. Transformers, switchgear, extensions to 6.6-kV switchboard, alterations to 6.6-kV cubicle in kiosk sub-station and an outdoor kiosk-type sub-station. (May 7th.)

Uruguay.—MONTEVIDEO.—June 14th. State Electricity Supply and Telephones Administration. Protective equipment against excess voltage for a 6/33-kV transforming station and two tapping posts for a 33-kV overhead power transmission line. (T.Y. 31344.)*
July 5th. R.i. copper conductors and flexible cords. (T.Y. 31351.)*

Walton and Weybridge.—May 18th. U.D.C. Electricity Department. Cables for one year. (April 30th.)

Ware.—May 22nd. U.D.C. Electric lighting installations at thirty-two houses on the Vineyard estate. (See this issue.)

Warrington.—May 17th. Town Council. Two electrically driven centrifugal pumps, each capable of delivering 150,000 gal. per hour. J. Gray, waterworks engineer, Town Hall.

Wolverhampton.—June 29th. West Midlands Joint Electricity Authority. Cables. (See this issue.)

* Further particulars from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Contracts Closed

Aberlour (MORAY).—Town Council. Accepted. Wiring of Council houses (£162).—A. McKinnon.

Durham.—County Council. Accepted. X-ray equipment at the Seaham Hall Sanatorium (£766).—Watson & Sons.

East Ham.—Electricity Committee. Accepted. 500-kVA transformer (£315).—English Electric Co. Switch unit (£178) and kiosk sub-station (£356).—Crompton Parkinson.

Hemel Hempstead.—West Herts Hospital General Committee. Accepted. Electrical installations in connection with the X-ray department and paying patients' block at the Hospital (£1,172).—C. J. Berry.

Lancaster.—Town Council. Accepted. Electrical installations in thirty-eight houses on the Main Street and Greaves housing estate (£219).—W. H. Inman.

Liverpool.—Clarence Dock Power Station Special Committee. Recommended. Interconnecting cables for the boiler-house switchboards and the condenser auxiliary switchboards in connection with Nos. 3 and 4 turbines at the Clarence Dock power station (£3,400).—Met.-Vick. Elecl. Co.
Electric Power and Lighting Committee. Accepted. Six rectifiers for sub-stations (£1,468 each).—B.T.H.

London.—L.C.C.—Wiring and fittings for electric lighting, &c., in forty-eight flats at Bayfield Street dwellings, Southwark:

	£		£
Archibald Meckhonik. Accepted	**346**	Holliday & Son (Electrical) ...	386
Carr Brothers	354	F. R. Short	423
Buxton and Longley	356	E. C. Sparkes	487
Berkeley Electrical Engg. Co. ...	371	Pemberton and Sturgess (Great Britain)	516
Commercial Light, Heat and Power Co.	376	Alexander Hawkins & Sons ...	521
Gladwell and Cook	385		

Accepted. Wiring and fittings for electric lighting, &c., in twenty-two flats at Rushworth Street dwellings, Southwark (£189).—A. Meckhonik.

Wiring and fittings for electric lighting, &c., in blocks 4 and 5 on the Peckham Rye site, Camberwell: —

	£		£
J. L. Shadwell. Accepted ...	**850**	Carr Brothers	919
E. and C. Champion	915	E. W. Merredew	972
Pemberton and Sturgess (Great Britain)	965	Anderson Angell & Co.	999
		Arthur Cozens	1,268

Wiring and fittings for electric lighting, heating and power at the Lucas Street school, Deptford:

	£		£
Holliday & Son (Electrical). Accepted	**989**	T. Clarke & Co.	1,114
City Electrical Co.	1,097	Caine Pernot	1,151
F. G. Edey & Co.	1,110	E. and C. Champion	1,153

DEPTFORD.—General Purposes Committee. Rewiring the Town Hall:

	£		£
Pruden & Pope. Recommended	**734**	Read and Partners	1,100
J. H. Plant	1,096	E. Dyne & Co.	1,400

Since these prices were received, there has been a considerable increase in the cost of materials, and Pruden & Pope are prepared to carry out the work for £801.

Maidenhead.—Town Council. Accepted. Four transformers (£564).—Hackbridge Electric Construction Co.

Manchester.—Housing Committee. Accepted. Electrical installations at 314 houses on the Crossacres estate.—W. E. Cheetham.

Electricity Committtee. Accepted. General lighting at Town Hall extension.—G.E.C.

Watch Committee. Accepted. Generating plant for reserve power supply at the police wireless station, Heaton Park.—R. A. Lister & Co.

Transport Committee. Accepted. Cadmium copper trolley wire.—F. Smith & Co. Fifteen six-wheel trolley-bus chassis (with Met.-Vick. electrical equipment).—Leyland Motors, Ltd. Eighteen four-wheel trolley-bus chassis (with Met.-Vick. electrical equipment), fifteen six-wheel type all-metal trolley-bus bodies, and eighteen four-wheel type all-metal trolley-bus bodies.—Crossley Motors, Ltd.

Shipley.—Electricity Committee. Recommended. Three disconnecting boxes (£104).—Callender's. 750-kW arc-rectifier equipment (£2,645).—Hewittic Electric Co.

South Shields.—Transport Committee. Accepted. Material for trolley-bus extensions: Cable (£113).—St. Helen's Cable and Rubber Co. (per N.E. Electric & General Supplies). Copper sheets and bars and overhead material (£207).—B.I. Cables. 12-section box panels (£14).—Turner's Asbestos Cement Co. 48-section box switches and two sets of links and studs (£119).—Parmiter, Hope & Sugden. Overhead material (£458).—M. Bonser & Co.

Town Council. Accepted. Electrical installations in houses (£998).—E. Nelson & Sons.

Torquay.—Education Committee. Recommended. Electrical installations at Audley Park schools (£3,835).—W. J. Furse & Co.

Worthing.—Health Committee. Accepted. Electrical work at the Swandean Isolation Hospital (£1,264).—Rashleigh Phipps & Co.

Highways Committee. Accepted. Thirty-one units for the mercury-discharge lighting of Brighton Road (£18 5s. each) and forty-six units for the sodium lighting of Jupps Lane, Mulberry Lane and Warren Road (£19 15s. each).—Brighton Lighting and Electrical Engineering Co.

Forthcoming Events

Institution of Electrical Engineers (*Hampshire Sub-Centre*).—Wednesday, May 19th. Municipal College, Portsmouth. 7.30 p.m. "Applications of the Hot-Cathode Grid-Controlled Rectifier, or Thyratron." Mr. A. L. Whiteley.

Irish Centre.—Thursday, May 20th. 1, Foster Place, Dublin. 3 p.m. Annual meeting.

Scottish Centre.—Friday, May 21st. Training College Hall, Dundee. 7.30 p.m. Joint meeting with the Dundee Sub-Centre. Faraday Lecture. "Electricity in the Hospital." Mr. R. S. Whipple. Saturday, May 22nd. Excursion to Taymouth Castle Hotel.

Western Centre.—Friday, May 21st to Monday, May 24th. Hotel Metropole, Minehead. Summer meeting.

Wireless Section.—Saturday, May 29th. Visit to the B.B.C. Television station, Alexandra Palace. Thursday, June 10th. Visit to the Television Exhibition, Science Museum, London.

Transmission Section.—Friday, June 18th, to Monday, June 21st. Visit to Holland.

Illuminating Engineering Society.—Wednesday, May 19th. Institution of Mechanical Engineers, London, S.W.1. 7 p.m. Annual meeting. Thursday, June 24th, to Wednesday, June 30th. Paris. International congress.

Institution of Chemical Engineers.—Wednesday, May 19th. Chemical Society, London, W.1. 6 p.m. "Platinum and Allied Metals." Major C. Johnson and Capt. R. H. Atkinson.

British Institute of Radiology.—Thursday, May 20th. Welbeck Street, London, W.1. Annual meeting.

Association of Mining Electrical Engineers (*South Wales Branch*).—Thursday, May 27th. Annual meeting. Tuesday, June 22nd, to Saturday, June 26th. Southport. Annual convention.

Incorporated Municipal Electrical Association.—Monday, May 31st, to Friday, June 4th. Brighton. Annual convention.

Diesel Engine Users' Association.—Wednesday, June 9th. Crewe. Summer meeting.

Tramways, Light Railways & Transport Association.—Wednesday, June 9th, to Saturday, June 12th. Edinburgh. Annual congress.

Institution of Heating & Ventilating Engineers.—Tuesday, June 22nd. Summer meeting.

Electrical Contractors' Association.—Wednesday, June 23rd. Blackpool. Annual conference.

Our Service Department

EVERY day inquiries of all kinds are received by the Editors, the bulk of them relating to the producers of specified classes of electrical goods. We are able to reply to most of these with the aid of our extensive records, but in a few cases we have to seek the assistance of our readers. This week we have been asked for the addresses of the following companies:—

British Alarmex Corporation, Ltd.
Ferguson Battery Co., Ltd.

Readers should enclose stamped addressed envelopes when making their inquiries.

Notes

International Institute of Electric Heat

During the sixth Congress of the Union Internationale des Producteurs et Distributeurs d'Energie Electrique at the Hague last year the Dutch Institute for Electric Heating and Electro-chemical Applications held an international congress of supply engineers, manufacturers and users interested in its special subjects. As a result it was decided to form an International Institute of Electric Heat and Electro-chemistry and to hold a congress every year. The E.D.A. Council has organised a British National Committee, which held its first meeting on May 3rd. The membership of the committee is as follows: Capt. J. M. Donaldson (North Met. Co.), chairman, Dr. T. Settle (General Electric Co.), vice-chairman, Messrs. E. P. Barfield (Wild Barfield Electric Furnaces), H. P. Barker (Unity Heating), A. C. Bostel (Sheffield), Comdr. F. J. Campbell Allen (Bastian & Allen), Messrs. H. W. Clothier (A. Reyrolle & Co.), F. Forrest (Birmingham), W. S. Gifford (Electric Furnace Co.), R. Lee (St. Pancras), A. G. Lobley (Birmingham Electric Furnaces), Lt.-Col. S. E. Monkhouse (North-Eastern Electric Supply Co.), Messrs. E. Morgan (S.W. & S. Co.), F. T. Nurrish (Geo. Bray & Co.), P. J. Robinson (Liverpool), F. Selley (St. Marylebone), W. E. Swale (Manchester), C. H. Yeaman (Stoke-on-Trent). Messrs. H. P. Barker and J. I. Bernard (E.D.A.) were appointed British representatives on the executive committee of the International Institute, which will hold a meeting at the end of May to consider arrangements for this year's congress in Paris, and provisional arrangements were made for the presentation of representative British papers.

Lighting Control on a Long Bridge

Supervision of the lighting of the eight-miles-long San Francisco-Oakland Bay Bridge, between the two Californian cities on either side of San Francisco Bay, is effected from a 26 ft. control board in the bridge administration building. On a black micarta board an elevation of the bridge has been engraved to scale, while above it is a plan of the bridge and its approaches. Lines running upward and across from the switches to the elevation and plan indicate the sections controlled by the switches. Lines which indicate the fog signals are in green; red lines are for navigation lights and the roadway lighting is indicated by orange lines. Approximately 600 small indication lamps show the position of each piece of equipment as well as the condition of each circuit. Roadway lights on the bridge have their miniature duplicates on the board, while navigation signals, aerial beacons, fog bells and sirens are also indicated.

Because of the distances between equipment and the control board it is necessary to perform all control and indications by d.c. through relays operating on a very small current. The system is fed from each end and sectionalised at Yerba Buena Island. If the supply should fail at either end the operator may restore service to that end by operating only one switch. At each of the bridge's six sub-stations the oil circuit-breakers are interlocked through a system of over-current relays so that only the circuit-breaker nearest the fault will trip out. By opening one switch and closing the centre sectionalising breaker the operator can restore service to the entire system, with the exception of the faulty section, in less than 15 seconds. Manual control would require from 15 to 60 minutes to restore service, depending upon the severity and the situation of the fault as well as the availability of men to perform the necessary operations.

Electricity at the Coal Face

The considerable saving effected by the use of electricity at the coal face was stressed in a paper on "Skipwinding and Mechanised Mining Electrically," which was delivered at Cardiff last week to the members of the South Wales Institute of Engineers by Mr. B. L. Metcalf and Mr. J. Hancock, of the Metropolitan-Vickers Electrical Co., Ltd. After referring to the importance of the South Wales coalfield and to the degree of electrification at the coal face, the authors gave a table of comparative costs which were ascertained recently at a colliery where electricity had completely replaced compressed air as the power medium. The table showed that there had been a direct saving of 3.5d. per ton as the result of the change. Further advantages of electricity and possible savings that might be made from its employment were cited by the authors, who concluded by saying there were signs that rapid developments toward the wider use of electricity underground were about to take place. Among those who took part in the subsequent discussion were Major E. Ivor David, Cardiff, Prof. T. David Jones, University College of South Wales and Monmouthshire, Cardiff, and Sir Arthur Whitton, Swansea. The meeting was presided over by Prof. F. Bacon.

Appointments Vacant

Plumber-jointers for Bethnal Green Electricity Department.

Senior assistant sub-station engineers for the North-Eastern Electric Supply Co.

Three district engineers for the Dumfries Electricity Department.

Technical officers in the Admiralty Technical Pool.

Junior engineer for Derby Electricity Department.

(See our classified advertisements.)

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

The Coronation Honours List.—As was anticipated the honours list to commemorate the Coronation of King George VI, which was published on Tuesday last, is one of the longest that has appeared, and it contains the names of several men connected with the electrical and allied industries. We give below a list of these, with brief notes on the their electrical associations:—

Colonel J. C. Denison-Pender, M.P., upon whom a barony has been conferred, is governor and managing director of Cable & Wireless (Holding), Ltd., and a director of associated companies; he is also chairman of the Marconi International Marine Communication Co., Ltd., and the Marconi Sounding Device Co., Ltd.

Knighthoods have been conferred upon **Mr. R. W. Dalton,** C.M.G., H.M. Senior Trade Commissioner in Australia, **Mr. L. Sterling,** managing director of Electric & Musical Industries, Ltd., and a director of Marconi-E.M.I. Television, Ltd., and other companies, and **Mr. E. T. Fisk,** a director of Amalgamated Wireless (Australasia), Ltd.

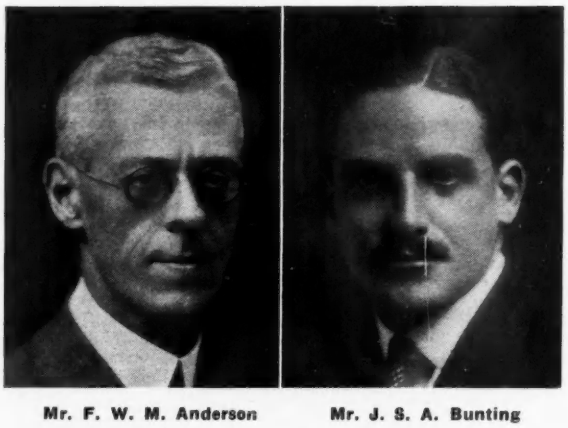
In the Dominion Services List, **Mr. T. R. Jephcott,** formerly chief engineer, Department of Posts and Telegraphs, Southern Rhodesia, and **Mr. P. Kennedy,** superintending engineer (South Australia), Postmaster-General's Department, Commonwealth of Australia, become Companions of the Imperial Service Order.

Mr. C. W. Reeve, chairman and managing director of the Associated Equipment Co., is awarded the C.B.E. (Civil Division), while the O.B.E. (Civil Division), has been conferred upon **Lt.-Col. C. G. Crawley,** inspector, Wireless Telegraph Section, G.P.O., **Mr. H. Dive,** M.B.E., Controller of Telephones, London Telecommunications Region, G.P.O., and **Mr. B. N. MacLarty,** engineer-in-charge of Stations Design and Installation Department, British Broadcasting Corporation.

The M.B.E. (Civil Division), is awarded to **Mr. A. E. Marson,** Senior Staff Officer, Electricity Commission, and **Mr. N. Sizer,** M.C., A.M.I.E.E., Engineer (acting), H.M. Office of Works and Public Buildings.

In the India Office List **Mr. H. Sur,** Posts and Telegraphs Department, Electrical Engineer-in-Chief, Calcutta, Bengal, is awarded the O.B.E., and **Mr. J. B. Gomes,** Posts and Telegraphs Department, Assistant Engineer, Telephones, receives the M.B.E.

Mr. F. W. M. Anderson, sales manager to W. T. Henley's Telegraph Works Co., Ltd., has been appointed assistant general manager to the company. Mr. Anderson joined the company in 1906, and was appointed assistant sales manager in 1913 and sales manager in 1925. **Mr. J. S. A. Bunting,** M.C., assistant sales manager, has been promoted sales manager; **Mr. G. E. Rhodes** becomes chief assistant to the management; and **Mr. E. J. Vidler** is appointed an assistant sales manager. All the appointments take effect as from May 1st.



Mr. F. W. M. Anderson **Mr. J. S. A. Bunting**

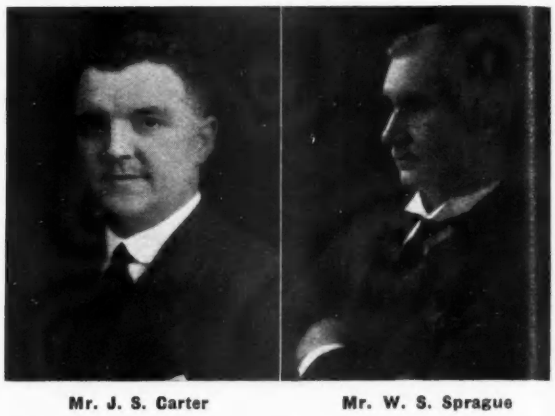
Mr. R. Alan Thwaites, M.Inst.C.E., of the North Wales Power Co., has been elected president of the North Wales Branch of the Association of Mining Electrical Engineers for a second year. Mr. Thwaites is a past chairman of the Yorkshire Centre of the Institution of Civil Engineers, and a former member of Committee of the Midland Centre of the I.E.E. and of the Yorkshire Centre of the I.Mech.E. Mr. Thwaites was to sail on the s.s *Orion* this week with Mrs. Thwaites for Athens.

Mr. H. Clark has ceased his responsibilities as managing director of Tangyes, Ltd.

Mr. R. Starkey has been appointed a director of Turner & Newall, Ltd.

Mr. F. M. Abbey has been appointed district representative for the Eastern Counties for David Brown & Sons (Huddersfield), Ltd. He has been in the company's employ at Huddersfield for nearly twenty years in various technical capacities and will be able to advise customers on all design and service matters in connection with gear drives. He has taken up residence at 24, Henley Road, Ipswich (telephone: Ipswich 3435).

Mr. W. S. Sprague, for the past eighteen years managing director of Chamberlain & Hookham, Ltd. (an asssociated company of the General Electric Co., Ltd.), has found it necessary to relinquish that position on account of ill health. Mr. Sprague, who recently completed forty years' service with the company, will, however, retain his seat on the board. **Mr. J. S. Carter** has been appointed to succeed Mr. Sprague as managing director. He has filled important positions with the company both at home and abroad for a long period, and for the last eight years has acted as sales manager.



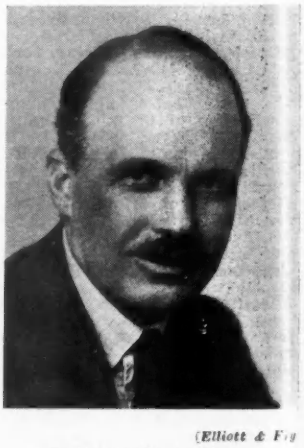
Mr. J. S. Carter **Mr. W. S. Sprague**

After 44 years' service with the Post Office, **Mr. S. J. Swinnerton,** traffic superintendent in the telephones department, Newcastle-on-Tyne, has retired. He has been connected with the telephone service since 1914. In 1932 he went to Newcastle as traffic superintendent from Liverpool.

Mr. S. Mavor, of Mavor & Coulson, Ltd., Glasgow, was re-elected president of the Mining Institute of Scotland at the annual meeting held on May 5th.

Mr. C. M. Mayson has retired on pension from the Charing Cross Electricity Supply Co., Ltd., after thirty-eight years' service as stations engineer. Mr. Mayson was educated at St. Bees School, Cumberland, and served his apprenticeship in the St. Rollox locomotive shops of the Caledonian Railway Co., Glasgow. He received his technical training at the Central Institution under Ayrton, Unwin, Armstrong and Henrici. He was for three years electrical engineer to the Whitehaven Corporation, and is a past president of the Diesel Engine Users' Association. His present address is "Greenacre," Bon Accord Road, Swanage, Dorset.

Professor W. L. Bragg, O.B.E., F.R.S., at present Langworthy Professor of Physics in the University of Manchester, has been appointed Director of the National Physical Laboratory, and will assume duty during next autumn. Professor Bragg was awarded the Nobel Prize for Physics in 1915 for work on X-rays and crystal structure with his father, Sir William H. Bragg. In 1931 he received the Hughes Medal of the Royal Society, and in 1932 was elected a member of the board of the Institute of Physics.



(*Elliott & Fry*)

Professor W. L. Bragg

Mr. W. T. Gann, A.M.I.E.E., has been appointed borough electrical engineer to the Southport Corporation in succession to Mr. E. Moxon, who has resigned on account of ill-health. Mr. Gann is a native of South Shields. After an apprenticeship with a firm of engineers and with the Dover Corporation Electricity Department he obtained a position as a junior assistant to that undertaking and subsequently secured an appointment with the Rochdale Corporation Electricity Department. Later he was appointed to the Southport Corporation Electricity Department; he occupied the position of mains engineer, being subsequently appointed deputy borough electrical engineer.

Mr. F. W. Hard, formerly assistant London manager of the India Rubber, Gutta Percha & Telegraph Co., Ltd., has

severed his connection with the Silvertown Company on account of their having discontinued the manufacture of rubber insulated cables, and has joined the Greengate & Irwell Rubber Co. as London cable representative. Comprehensive stocks of all standard cables will, we are informed, be held at Canning Town to ensure immediate deliveries in the London district.

Mr. G. L. Tomlinson has resigned from the position of assistant in the Blackburn consumer engineer's department consequent upon receiving an appointment with the electricity undertaking at St. Helens.

I.E.E. Awards.—The Council of the Institution of Electrical Engineers has made the following award of premiums for papers read during the session 1936-37, or accepted for publication:—Institution: Messrs. E. A. Speight and O. W. Gill. Ayrton: Dr. D. Robertson. Fahie: Col. A. S. Angwin and Mr. R. A. Mack. Kelvin: Messrs. T. E. Allibone, D. B. McKenzie and F. R. Perry. Paris Exhibition (1881). Mr. J. A. Sumner. Overseas: Messrs. A. L. Green, G. Builder and O. O. Pulley. Extra: Dr. P. Dunsheath, Messrs. L. H. Harris, E. H. Jolley and F. O. Morrell, H. Trencham and K. J. R. Wilkinson, Messrs. W. R. Debenham, W. Jackson and H. A. Thomas. Wireless Section: Messrs. Benjamin, C. W. Cosgrove and G. W. Warren (Duddell Premium), Commander F. G. Loring, Messrs. W. L. McPherson and W. H. McAllister, and T. L. Eckersley. Meter and Instrument Section: Messrs. W. F. Randall, E. Hughes, C. Dannatt, Prof. J. T. MacGregor-Morris and Mr. V. A. Hughes. Transmission Section: Mr. H. G. Taylor (Ferranti Premium) and Mr. J. Eccles.

Mr. N. Bruce, F.C.I.S., has been appointed secretary to Venner Time Switches, Ltd., in succession to the late Mr. H. G. White.

Obituary

Mr. J. C. Vaudrey.—By the death last week at the age of 83 years of Mr. John Clough Vaudrey, the band of pioneers whose association with electricity supply interests dates back to the eighties of last century has been further reduced. He was prominently associated with electricity development in Birmingham for many years, and his connection therewith ceased so long ago that probably many of our readers have only a remote acquaintance even with his name. There were few electricity supply engineers or managers in 1889 when the Birmingham Electric Supply Company was formed. He was its managing director right from the beginning, and when the business was taken over by the Corporation in 1900 he was appointed its engineer. He continued in that capacity for three years and subsequently in a consultative office for another year. Since then he had devoted himself to the interests of voluntary hospital work in the City of Birmingham. He also served in public affairs generally and was a life governor of Birmingham University. The funeral took place last Saturday.

Will.—The late **Mr. Thomas Bolton,** of Thomas Bolton & Son, left £54,345 with net personalty £42,423.

Approved Flameproof Equipment

THE quarterly schedule of electrical apparatus certified as flameproof during the three months ended March 31st last has been issued by the Mines Department. The list briefly describes equipment made by twenty-two manufacturers, excluding modifications of devices previously certified. Tests are now made in three groups, to comply with industrial as well as mining conditions, namely: (I) methane (firedamp), (II) petroleum and acetone vapour, (III) coke-oven and coal gases, as indicated in parentheses below. Group III tests are provisional only, reports being issued thereon, but no certificates are yet issued.

Anderson Boyes & Co., Ltd., Motherwell.—Gate-end circuit-breakers, connectors, combined coalcutter motor and reversing starter (I).

British Jeffrey-Diamond, Ltd., Wakefield.—Bus-bar chambers, pilot switches (I).

British Thomson-Houston Co., Ltd., Rugby.—Contactor switches, slip-ring units, cable joint box (I), controller instruments (I and II), petrol pump motors (II).

Cowlishaw, Walker & Co., Biddulph, Stoke-on-Trent.—Combined coalcutter motor and reversing starter (I).

Electrical Apparatus Co., Ltd., London.—Haulage control panel (I), motor control panels (I and II, with watertight alternative for ships).

Erskine, Heap & Co., Ltd., Salford.—Auto-transformer, straight-on, star-delta and change-over starters (I and II).

Wilfrid Francis & Co., Ltd., Altrincham.—Drum controllers, circuit-breakers, reversing switch, connector (I).

General Electric Co., Ltd., Birmingham.—Slip-ring units (I), bus-bar unit (I and II), floodlight fitting (II, excluding acetone vapour), well-glass lighting fitting, switch and fuse units, bus-bar unit, multi-panel coupling (III).

Horace Green & Co., Ltd., Cononley, Keighley.—Motors and starters (I).

Greenwood & Batley, Ltd., Leeds.—Motor (I).

Edward Holme & Co., (1931), Ltd., Altrincham.—Brake solenoids (I and II).

Hopkinsons, Ltd., Huddersfield.—Shaft signalling unit (I).

Laurence, Scott & Electromotors, Ltd., Norwich.—Slip-ring units, motors, generators (I and II).

M. & C. Switchgear, Ltd., Glasgow.—Starters (I and II), circuit-breaker (I).

Mather & Platt, Ltd., Manchester.—Motors (I and II).

Metropolitan-Vickers Electrical Co., Ltd., Manchester.—Slip-ring unit (I), pillar switchgear, circuit-breakers, drum controller (I and II).

Mining Engineering Co., Ltd., Worcester.—Motor, reversing starter (I).

Morley Electrical Engineering Co., Ltd., Stanningley, Leeds.—Motor (I).

Revo Electric Co., Ltd., Tipton, Staffs.—Well-glass lighting fitting (II).

Switchgear & Cowans, Ltd., Manchester.—Potential transformer unit, thermal overload unit, cable dividing box (I).

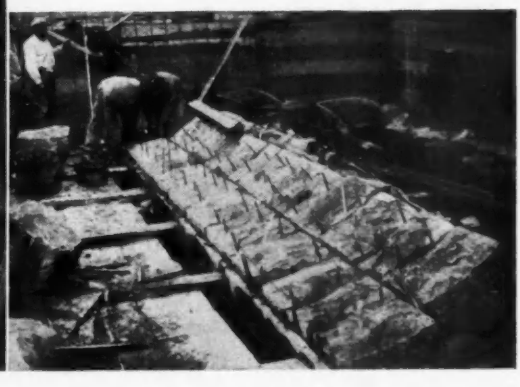
Veritys, Ltd., Aston, Birmingham.—Motor and cable sealing box (II).

Warming Concrete Electrically

SWISS engineers have been carrying out experiments with a view to preventing concrete from freezing when it is cast during the winter months. The basis of the tests was the resistance of the water in the concrete which became the heating elements.

Three different systems were tried. In one the concrete, after pouring, was covered with tarpaulins, to the under surface of which 5-in. wide strips of sheet metal spaced 2 in. apart were fixed, alternate strips being connected to the two poles of an a.c. circuit. In the second method, used along beams, the sheet metal was placed in the moulds before casting and the sheets on opposite sides connected to the lead and return wires. The third system consisted of driving short lengths of scrap reinforcing rods into the concrete after pouring, and connecting these to the source of current.

No heat insulation was used in these tests, as the wood moulds were considered sufficient. In order to avoid risk of shock the voltage is stepped down to from 25 to 50 V, this range permitting a variation in the speed of heating. The heating period was about fifteen or sixteen hours, during which about 500 W per cubic yard of concrete heated 1 deg. F. was found to be needed with an ambient temperature of 15 deg. F. The heating process is said to result in a concrete presenting equal strength to that poured in summer.



Experiments in electrically heating concrete. The left-hand picture shows the "electrode" carpets laid over a concrete floor in a Zurich building. The other is a view of the Ochsenboden Dam showing the placing of the electrodes between the stones on the facing

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

Amcolite, Ltd.—Private company. Registered May 6th. Nominal capital, £50,000. Objects: To carry on the business of sign manufacturers, electrical and general engineers and contractors, manufacturers of and dealers in mathematical and scientific instrument makers, &c. The subscribers are: L. C. J. Green, 21, Talbot Road, Harrow Weald, Mdx.; and W. Head, 1, Stanley Gardens, W.11. Registered office: 32, Sackville Street, W.1.

G.5.N.I. (Birmingham), Ltd.—Private company. Registered April 29th. Capital, £100. Objects: To acquire the business of a dealer in wireless equipment carried on by W. H. D. Nightingale at 44, Holloway Head, Birmingham, and at branch offices throughout the city and registered under the Business Names Act as Radio Mart. The directors are: W. H. D. Nightingale and Mrs. L. Nightingale, both of 3, Beaks Hill Road, Birmingham. Registered office: 44, Holloway Head, Birmingham.

Raymart, Ltd.—Private company. Registered April 29th. Capital, £100. Objects: To acquire the business of a manufacturer of and dealer in wireless equipment carried on by W. H. D. Nightingale at 44, Holloway Head, Birmingham, and registered under the Business Names Act, 1916, as Raymart Mfg. Co., and also to acquire the trade mark of "Raymart," application No. 558236 in Class 8. The directors are: W. H. D. Nightingale and Mrs. L. Nightingale, both of 3, Beaks Hill Road. Secretary: Mrs. L. Nightingale. Registered office: 44, Holloway Head, Birmingham.

Scarborough Mitchell & Co., Ltd.—Private company. Registered May 5th. Capital, £500. Objects: To carry on the business of electricians, electrical engineers and contractors, automobile engineers, &c. The permanent directors are: R. J. Scarborough, 4, Friern Park, N.12, and three others. Registered office: 4, Friern Park, North Finchley, N.12.

Lane Radio (Birmingham), Ltd.—Private company. Registered May 5th. Capital, £100. Objects: To acquire the business of a manufacturer of and dealer in radio gramophones and musical instruments carried on by C. A. Taylor as Lane Radio, at 244, Ladypool Road, Sparkbrook, Birmingham. The permanent directors are: C. A. Taylor and Mrs. M. Taylor, both of 272, Vicarage Road, Kings Heath, Birmingham, 14. Registered office: 244, Ladypool Road, Sparkbrook, Birmingham.

Gordon Elf, Ltd.—Private company. Registered May 5th. Capital, £1,000. Objects: To carry on business as vendors, dealers, agents, repairers (but not manufacturers) of electric accumulators, batteries, acids and containers, wireless aerials, &c. The directors are: G. V. Northcott, Bury Lodge, Gosport, Hants, and two others. Registered office: 17a, Hanover Square, W.1.

H. A. Hartley Co., Ltd.—Private company. Registered in Edinburgh May 4th. Capital, £100. Objects: To carry on the business of merchants of, agents for and wholesale and retail dealers in radio, television and electrical apparatus, &c. The directors are: H. A. Hartley, 2, Heron Court, Richmond, Surrey; and E. H. Dew, 24, Heston Park Road, Hounslow. Secretary: E. H. Dew. Registered office: Drumarbin, Fort William, Inverness-shire.

Gullick & Lock, Ltd.—Private company. Registered May 1st. Capital, £2,000. Objects: To acquire the business of electrical and radio engineers and contractors carried on by E. E. H. Gullick and F. C. Lock at Epsom. The directors are: F. C. Lock, 68, Tolworth Rise, Surbiton, Surrey, and E. E. H. Gullick, 22, West Street, Epsom, Surrey. Registered office: 22, West Street, Epsom, Surrey.

Wholesale Electrical Accessories (Slough), Ltd.—Private company. Registered May 1st. Capital, £1,000. Objects: To carry on the business of manufacturers and agents for the sale of and dealers in electrical accessories and equipment, cable conduits, switchboards, control gear, &c. The directors are: J. D. Halliday (permanent) and Mrs. M. A. Halliday, both of West End House, Stoke Park, Slough.

Heatex Co., Ltd.—Private company. Registered in Dublin on April 30th. Capital, £5,000. Objects: To acquire the business of manufacturers of drying apparatus and appliances by means of electricity, gas and oil carried on as the Heatex Company. The subscribers are: A. E. Healy, 8, Islington Avenue, Dun-Laoghaire, Co. Dublin, and M. J. Byrne, Glen Imail, 98, Kimmage Road, W., Dublin. Arthur E. Healy is the first director.

W. Kerr & Son, Ltd.—Private company. Registered April 29th. Capital, £2,000. Objects: To carry on the business of dealers in and manufacturers of radio and television apparatus, &c. The directors are: W. B. Kerr, 25, Grove Park Road, N.15, and W. Kerr, 21, Church Road, N.1. Registered office: 105, West Green Road, W.15.

Henry Jones (Tunstall), Ltd.—Private company. Registered May 6th. Capital, £100. Objects: To carry on the business of radio-telephony reserach engineers, &c. The directors are: H. Jones (managing director and chairman), 8, Alfred Street, Tunstall; and A. Rowley, Hollywall Farm, Chatterley, Tunstall.

J. & J. D. Moore, Ltd.—Private company. Registered April 29th. Capital, £500. Objects: To carry on the business of manufacturers of and dealers in refrigerators, wireless, telephone and telegraph apparatus, &c. The permanent directors are: J. Moore, 4, Oakroyd Villas, Manningham, Bradford, and H. Obank, Woodhall Park, Fursley, Stanningley, near Leeds. Registered office: Britannia House, Leeds Road, Bradford.

Returns of Electrical Companies

British Foreign and Colonial Automatic Light Controlling Co., Ltd.—Mortgage on freehold premises 96 and 98, Holdenhurst Road, Bournemouth, with plant and machinery, dated April 12th, 1937, to secure all moneys due or to become due from the company to National Provincial Bank, Ltd.

South Beds Electrical Finance, Ltd.—The nominal capital has been increased by the addition of £22,000 beyond the registered capital of £8,000. The additional capital is divided into 7,000 ordinary and 15,000 5½ per cent. redeemable preference shares of £1 each.

Wm. G. Walter (Bath), Ltd.—Satisfaction to the extent of £500 on April 23rd, 1937, of charge dated November 16th, 1936, and registered November 28th, 1936. (According to the register of mortgages, the charge registered November 28th, 1936, originally secured £500.

Mortgage on property known as The Old Bath Prison, Tiverton, Bath, but intended to be called "Stuart Works," dated April 24th, 1937, to secure £1,500. Holders: Bath, Somerset, Gloucester and Wilts Permanent Benefit Building Society, 6, Pierrepont Street, Bath.

Carmarthen Electric Supply Co., Ltd.—Satisfaction in full on January 31st, 1931, of second debentures authorised September 23rd, 1918, and registered October 14th, 1918, securing £2,750. (Notice filed April 27th, 1937.)

Morton Industries, Ltd.—Two debentures charged on the company's undertaking and property, present and future, dated April 16th and April 26th, 1937, to secure £500 and £250 respectively. Holder: Gwendolen N. Samson, 86, Highland Heath, Putney, S.W.

Zenith Electric Co., Ltd.—Capital, £26,250 in 25,000 ordinary shares of £1 and 25,000 deferred shares of 1s. Return dated December 15th, 1936. 25,000 ordinary and 23,334 deferred shares taken up. £5,563 paid on 5,563 ordinary shares, £20,603 14s. considered as paid on 19,437 ordinary and 23,334 deferred. Mortgages and charges nil.

Henderson's Wholesale Electrical & Radio, Ltd.—Norman W. Wild, of 42-5, New Broad Street, E.C.2, was appointed receiver and/or manager on April 26th, 1937, under powers contained in debenture dated February 4th, 1936.

Vulco Dry Battery Co., Ltd.—Capital, £8,000 in 1,500 preference and 6,500 ordinary shares of £1. Return dated October 26th, 1936. All shares taken up. £3,667 paid, £4,333 considered as paid. Mortgages and charges nil.

Mek-Elek Engineering, Ltd.—Capital, £2,000 in £1 shares. Return dated November 24th, 1936. 1,500 shares taken up. £1,500 paid. Mortgages and charges nil.

Thermics, Ltd.—The nominal capital has been increased by the addition of £4,800 in £1 shares beyond the registered capital of £200.

City Notes

Johnson & Phillips, Ltd.—Increases during 1936 of 25 per cent. in value of the company's output and practically 50 per cent. in orders carried forward as compared with the previous year were reported by Mr. G. Leslie Wates (chairman) in the course of his speech at the annual meeting on May 6th. Although this improvement, he said, was to some extent due to higher prices, it largely represented an increase in volume of business which had been spread fairly uniformly over practically all departments, and had consisted of a general increase in the number of orders for standard lines rather than in special contracts. The revival of shipbuilding had led to an expansion in orders for ship-wiring cables, and there had been a greatly increased demand for mining-type cables. The rearmament programme could not be said to have affected the turnover for 1936, but its effects were now beginning to be felt and would be reflected in the company's business mainly in the form of increased demand from ordinary customers for standard lines of manufacture. Business with overseas branches, agencies and customers was being fully maintained. The Condenser Department had had a very satisfactory year, and had secured important contracts for condensers for power-factor improvement. A large contract had also been placed for voltage maintenance condensers. Water-heater business continued to develop, and the reliability and durability of the "Charlton" heater was appealing to supply authorities who desired to minimise service and maintenance costs. The company's subsidiary, British Permel Enamelled Wire, Ltd., had worked to capacity throughout 1936, and the turnover in 1936 was almost double that of 1935, although it had not been possible to make a profit after covering all expenses. The increased output now possible would, however, they hoped, enable them to achieve the desired result by the end of the current year. In common with other cable companies it was proposed this year to give all workpeople one week's holiday with pay, the works being closed for the week commencing with August Bank Holiday. If the National Defence Contribution Tax were imposed on the lines of the Chancellor's speech it would not interfere with the usual dividend distribution. About £600,000 was invested in subsidiary electricity supply companies. During 1936 capital expenditure of upwards of £90,000 had been made in the development of these undertakings, and they had schemes in hand for further necessary developments which would involve expenditure in the neighbourhood of, say, £100,000 during 1937. This expenditure was largely in the rural area of Westmorland and in the Ringmer district. In view, however, of the Government's proposals for legislation on the lines of the McGowan Report the directors did not propose to proceed with these schemes. Any capital required pending Parlia-

ment's passing the legislation necessary to carry the Report into effect would be provided by the bank in the usual way. In view of the congested state of business in Parliament he hardly imagined that any Bill could be introduced before the autumn, and it was therefore not likely to come into operation until the latter part of 1938 or even 1939. At December 31st last they had 384 miles of distribution mains in operation and purchased and generated practically 20 million kWh during the year, an increase of 40 per cent. on 1935, which itself showed an increase of 48 per cent. on 1934. Over 9,500 consumers were connected at the end of 1936, but the profit per kWh sold was only ¼d., out of which had to be provided transmission losses and interest on capital. Revenue had increased by 31 per cent. as compared with a sales increase of 40 per cent.

The London Electric Wire Co. & Smiths, Ltd.—Presiding at the annual meeting on May 6th Mr. W. J. Terry (chairman and managing director) mentioned that during the year the plant and machinery had been kept in good repair and were mostly working to full capacity. He said that commodity prices had advanced steadily during 1936, electrolytic copper having risen from £39 15s. per ton to £54 10s. per ton. In the current year, on the announcement of the armament programme, the price of this commodity had increased to £81 per ton and later reacted to £62 10s. per ton. The prospects for the next few years were that copper prices would be at a higher average than during the past three years. However, they experienced no difficulty in obtaining the necessary raw materials and in respect of copper had been particularly well served. Their products had been maintained at a high standard and the demands for their goods in the past year had created a record tonnage output. Export sales had also increased in a similar proportion to their home sales. The selling prices of their finished products were only advanced in accordance with the prevailing day-to-day market price of copper and the profit on sales had not resulted in a record figure. Demands of the trade were still increasing and extensions to both buildings and plant had been started, while further extensions were being contemplated. The Factories Bill, 1937, now before Parliament, might also mean still further additions to plant and machinery, which might become redundant under normal conditions. During the past year particular attention had been given to research and to the manufacture of their products by the most efficient methods. With regard to the Chancellor of the Exchequer's proposals for a National Defence Contribution, Mr. Terry felt that in the absence of further information it was not possible to compute their company's liability. The principle had received general acceptance, but the doubt which existed was whether the burden would be spread in a fair and equitable manner. As to the future, the electrical industry continued to make substantial progress and existing orders on hand indicated that their output in the current year would at least equal that of 1936, provided conditions remained unchanged.

Marconi's Wireless Telegraph Co., Ltd., held its annual meeting on May 6th, when Lord Inverforth (chairman), who presided, in referring to the rise in the ordinary dividend, said that they took a more hopeful view of the general position than twelve months ago. Three-fourths of their sales were to customers overseas. The flow of orders for wireless equipment from all parts of the world, referred to last year, continued to the end of 1936 and sales were of a value higher than in the boom year of 1929. In the current year they had experienced a further rise in orders booked in the first four months. Against this it must be remembered that the percentage of profit earned in their manufacturing business had been decreasing and continued to diminish, and it must also be pointed out that the profits resulting from orders obtained in 1936 were only partially realised in that year. They intended to extend and intensify their activities in the research departments and in connection with this they had added fifty-four members to their technical staff, while in the year under review they had filed 987 applications for new patents and produced or acquired rights in more than 250 additional patents. Of these, fifty-six were applicable to sound or television broadcast reception. The extension of their works at Chelmsford was completed recently, and as the additional space provided was already fully occupied they had under consideration the advisability of further enlargements. A pension scheme had been introduced last October and they had now made provision for all grades of their employés.

Bruce Peebles & Co., Ltd., report a profit for 1936 of £37,796, which with £2,054 brought in makes £39,850. Of this £32,000 is carried to depreciation account, leaving a balance of £7,850. It is proposed to pay one year's dividend on the preference shares at 7½ per cent. per annum, less tax, for the year to December 31st, 1930, and to carry forward £4,020. The report states that the improved trading results mainly arise from a much-increased turnover. During the last three years £35,000 of capital expenditure has been incurred in new machinery and plant, so as to improve the efficiency of the works. The directors have had under consideration various suggestions for the capitalisation of the arrears of the preference share dividends, &c., so as to ensure the adequate development of the business, and discussion on these will be invited at the annual meeting in Edinburgh to-day (Friday).

The Ever Ready Co. (Great Britain), Ltd., reports net profits for the year ended March 31st of £527,333, as compared with £432,780 for 1935-36. Of this £112,059 is placed to reserve and £8,958 is set aside for donations and staff benevolent fund. The final ordinary dividend is 20 per cent., plus a bonus of 10 per cent., making a total distribution for the year of 45 per cent. (against 35 per cent.), and £63,417 is carried forward (against £59,152 brought in). Meeting: June 3rd.

The Cawnpore Electric Supply Corporation, Ltd., reports a surplus on the past year's working of £104,949, as compared with £98,537 in 1935. After deducting debenture interest and adding £4,440 brought in, it is proposed to transfer £50,000 to depreciation and renewals and £10,000 to income-tax account. It is proposed to pay a final ordinary dividend of 7 per cent., making 10 per cent. for the year (same), and to carry forward £5,137.

Allen West & Co. report a net profit for the year ended January 31st of £37,352, after placing £15,000 to depreciation reserve. This is an increase of £29,056 over the balance for the previous year, when £25,000 was provided for depreciation. No dividend is recommended. The last ordinary distribution was 6 per cent. in respect of the year 1929-30.

The Melbourne Electric Supply Co., Ltd., has announced an interim dividend on the consolidated ordinary stock of 1¼ per cent., free of tax (against 1½ per cent.).

E. K. Cole, Ltd., propose to pay a final dividend of 17½ per cent. on the ordinary shares, making a total distribution for the ten months to March 31st of 30 per cent., which is equivalent to 36 per cent. per annum. It is also proposed to pay a participating dividend of 2½ per cent. actual (being at the rate of 3 per cent. per annum) on the 7 per cent. cumulative participating preferred ordinary shares in respect of the period ended March 31st, 1937.

The Telephone Manufacturing Co. reports a net profit for 1936 of £31,324, as compared with £22,294 in the preceding year, to which is added £4,034 brought in. The final dividend is 6½ per cent., making 9 per cent. for the year (against 7½ per cent.), general reserve receives £5,071, and £9,278 is carried forward. Meeting: May 19th.

Richard Johnson & Nephew, Ltd., report net profits for the year ended March 31st of £52,444, as compared with £33,502 in the previous year. Reserve for pensions receives £10,000, and general reserve £20,000. It is proposed to pay an ordinary dividend for the year of 8 per cent. (against 6 per cent.), and to carry forward £24,973 (against £36,410 brought in).

The Craigpark Electric Cable Co. has received an offer for the purchase of all the shares of the company at 35s. per £1 ordinary share and 25s. per £1 cumulative preference share, subject to the condition that acceptances are received in respect of 90 per cent. of all the issued shares of the company. The directors have accepted the offer and recommend that shareholders should also accept.

Edmundsons Electricity Corporation, Ltd., reports that the results of the operations of its group of companies during April, as compared with the corresponding month of 1936, show an increase of 21 per cent. of kWh sold.

Siemens Bros. & Co., Ltd., have declared a dividend of 7½ per cent. for 1936 (against 6 per cent.) on the ordinary stock.

The Electrolux Corporation has declared a quarterly dividend of 40 cents regular and 10 cents extra (unchanged).

East India Tramways is paying an interim dividend of 4 per cent., tax free (same).

The Associated Equipment Co. has declared an interim dividend of 2 1/12 per cent., free of tax (same).

Stocks and Shares

MONDAY EVENING.

IN days prior to the amalgamation of various London electricity supply companies such an event as the Coronation would have had a marked effect upon the prices of the companies' shares in directing investment attention to them by reason of the additional profit likely to accrue from the illuminations, &c. With London sitting up most of the night for the greater part of this week it may well be supposed that the extra amount of "juice" required is likely to be considerable, but with the standard dividend virtually fixed at 7 per cent., save in exceptional circumstances, there is little temptation for the investor to indulge in mild speculation on revenue results. The Stock Exchange has recovered to a great extent the equilibrium so badly shaken by the events of the last two Stock Exchange settlements. A good start has been made towards recovery of lost ground. In spite of the fact that business has suffered a natural interference from the historic events of the week, there is a certain amount of investment and speculation in progress. The investment markets keep steady, notwithstanding the continuance of the bus strike and the threat of similar outbreaks in other directions.

London Transport

The price of London Transport "C" stock fell at the first threat of labour trouble from 90 to 87, and was further depressed to 84½ by subsequent developments. Apprehension is now concerned no less with the actual loss of revenue during the stoppage, which loss is probably lighter than at first sight was feared than with the facts which came to light at the inquiry and with the possible consequences of the men's claim. Such optimism as "C" stock holders may have entertained on the strength of the Board's increased receipts was suppressed by the admission that rising expenses have left the financial position no less unsatisfactory than it was at this time last year. On top of this stock holders have to face the outcome of the dispute. Whatever the outcome proves to be, the prospect of "standard" interest payments must look, to holders of the "C" stock, to have receded, and the fall in the price reflects this uncomfortable consideration.

The "Standard" Rate

Inquiry has been looking up the terms of the Act of 1933 to gain acquaintance with the consequences of persistent failure on the part of the London Transport Board to pay interest at the "standard" rate on the "C" stock. The standard was set at 5½ per cent. for the three years, of which next year is the last. So far nothing higher than 4 per cent. has been paid in any one year. If the full 5½ per cent. is not forthcoming in 1938 holders of the "C" stock may, according to the Act, apply for the appointment of a receiver.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberdare.—Factory for the Aberdare Cables, Ltd.

Aldridge (WALSALL).—Cinema, with shops, Anchor Road, and cinema, the Square, Rushall, for A. H. Braine, Hamstead Road, Great Barr, Birmingham.

Altofts (NORMANTON).—Houses (32) and bungalows; W. Martin Jackson, architect, 6, Snydale Road, Normanton, Yorkshire.

Annfield Plain.—Houses, Lily Terrace Dipton, Flint Hill, Front Street and Hare Law; U.D.C. surveyor.

Audenshaw.—Houses (24), Booth Hall estate; C. F. Napper, Station Parade, Harrogate.

Bangor.—Houses (30) and shops, central redevelopment area; B. Price Davies, city architect, Town Hall.

Bewdley.—Houses (60), Berk Hill; S. J. Rowe, borough surveyor, Town Hall.

Birkenhead.—Houses (96), Ilchester Road (£51,100); Lloyd & Cross, Ltd. Flats (42), near Well Lane; Mr. Wannop, junior.

Birmingham.—Premises, Lupin Street, for R. Rigby, Ltd.; L. F. Ward, architect, 55, Newhall Street.

Blackpool.—Houses (62), Calder Road; R. Fielding & Son. Cinema and café, Dickson Road; S. Taylor.

Blackrod.—Houses (24), Whitehall Lane; A. Heyes, clerk.

Bridlington.—Cinema, Promenade; C. E. Wilford, Leicester.

Burton-on-Trent.—Houses (55), Rosliston Road, borough surveyor, Town Hall.

Carlton (NOTTINGHAM).—Houses (33), Station Road; J. A. West, U.D.C. surveyor, Council House, Burton Road.

Chester.—School, Newton; city surveyor, 43, Northgate Street, Chester.

Chesterfield.—Houses, Bacon's Lane; W. S. Wilson, borough surveyor.

Consett.—Houses (200), The Grove; U.D.C. surveyor.

Corsham (WILTSHIRE).—Houses (20), Providence Lane, for E. Merrett.

Dalton-in-Furness.—Houses (20), Romney Park; R. Higgin.

Derby.—Municipal Administrative Buildings, central site (£214,029); city architect, Council House.

Dorset.—Extensions and alterations to County School for Girls, Dorchester, for C.C.; Broad & Dockerill, quantity surveyors, 44, Holdenhurst Road, Bournemouth.

Drayton.—Houses (30); R.D.C. surveyor.

Easington.—Houses (308), in connection with slum clearance scheme; R.D.C. surveyor.

Eastbourne.—Houses (22), Lottbridge Drive; G. Evans, Swansea.

East Retford.—Houses (36), Lidget Lane, and bungalows, Thrumpton (£14,856); R. E. Wilson, borough surveyor.

Elland.—Houses (22), Westbury Street and Elland Lane; A. O. Crowther, builder.

Ely.—Houses (40), various sites; F. W. Green, clerk, Ely, Cambridgeshire.

Glasgow.—Reconstruction of business premises, Argyle Street (£500,000), for the Lewis's Royal Polytechnic, Ltd.

Gloucestershire.—School, Filton (£17,605), for County E.C., Shire Hall, Gloucester.

Hatfield.—Houses (20), Welham Green; R.D.C. surveyor.

Hereford.—Development of Withy Brook estate, Holme Lacy Road; H. Lidster. Extensions to canning factory, Burghill Road; J. Goodwin.

Hertford.—Houses (63), Horns Mill site (£24,178); borough surveyor.

Houghton-le-Spring.—Houses (22), Band Hill estate; R.D.C. surveyor.

Ilkeston.—Houses (260), Green Lane estate (£90,480); F. Perks & Son, Ltd.

Irish Free State.—(NEWCASTLE, Co. TIPPERARY).—Technical school, for South Tipperary Vocational Education Committee of Clonmel; V. Kelly, architect, 87, Merrion Square, Dublin. (KILLARNEY, Co. KERRY).—Town Hall; J. R. Boyd Barrett, architect, 61, South Mall, Cork.

Kirkcudbright.—Conversion of Burnside House into County Buildings (£12,700); county clerk, Kirkcudbright.

Lancashire.—School, Penwortham, for County E.C.; C. B. Pearson & Son, 18, Dalton Square, Lancaster.

Lancaster.—Houses (300), in connection with the slum clearance; F. Hill, borough surveyor.

Leeds.—Extensions to nurses' home, Killingbeck sanatorium; city architect.

Littleborough.—Houses, Shore Road, construction of roads and sewers, &c. (£15,500); J. E. Stott, architect, Bridge Street, Todmorden.

Liverpool.—Houses (608) and shops, Speke Street, Woodfal Heath Street and St. Oswald Street; director of housing, Blackburn Chambers, Dale Street.

Llanelly.—Houses (54), Morfa; borough surveyor, Town Hall.

London.—(WOOLWICH).—Hostels, Avery Hill training college (£30,513); J. & C. Bowyer, Ltd., Haynes Lane, S.E.19. (CAMBERWELL).—Depôt, Peckham Park Road (£20,797); Alan V. Goad, 241, Camberwell Road, S.E.5.

Manchester.—Houses, Blackley, Higher Crumpsall and Newton Heath; city architect. Cinema, Erskine Road, Hulme; A. R. Walsingham. Premises, Grangethorpe, for High School for Girls; governors.

Market Drayton.—Houses (48), Shrewsbury Road; P. P. Baddeley Bros., builders, Wolstanton, Staffordshire.

Mersham.—Estate development, Main road; Mersham Manor, Ltd.

Nailsworth.—Houses (30); G. H. Pavey-Smith, solicitor-clerk.

Nairn.—Houses, Cowdor Road (£31,500); J. H. G. Peter, burgh surveyor, Queen Street.

Newcastle-on-Tyne.—Houses, Benfield Road, and houses in flats; Hadden and Hillman, builders, Huddleston Road, Heaton. X-ray therapy centre at the General Hospital, for City Council; city architect. School, Cragside, and remodelling of the Chillingham Road school, for City E.C.; director of education. Extensions to St. Dominie's Priory; R. Burke, architect, Singleton House, Northumberland Street.

Norham.—Houses, Scremerston; Gray and Paterson, architects, Berwick-on-Tweed.

Northumberland.—School, Pegswood (£13,278), for County E.C.; W. S. Wilson.

Nuneaton.—Premises, Queen's Road, for the Co-operative Society, Ltd., Abbey Street; H. N. Jepson, architect, Midland Bank Chambers, Newdegate Place.

Oswestry.—Houses, St. Martins, Gobowen and Trefonen; R.D.C. surveyor.

Plymouth.—Houses (56), Ashburnham Road; T. Mitchell. Houses, Church Hill; M. Solomon.

Pontefract.—Houses, near Portland Avenue; Leach Bros. School, Carleton estate, for E.C.

Ramsbottom.—Extensions to works for Porritt Bros., and Austin, Ltd., Stubbins Vale mills; A. England, architect, 16, St. Andrew's Road South, St. Annes-on-Sea.

Richmond.—Estate development, Red Lion Street; Couch & Coupland, 37, Sheen Road.

Rotherham.—Houses (48), Catcliffe and Brinsworth; A. E. Lant, R.D.C. surveyor, Moorgate.

Rowley Regis.—School, City Road estate, Tividale, for E.C.; Pritchard, Godwin & Clist, architects, Bank Chambers, Kidderminster.

Rugby.—Houses, Rainsbook and Gorse estate; R. Gardner, The Croft, Hillmorton. Houses (86), Bullmeadow site, Parkfield Road; W. H. Spicer, borough surveyor.

St. Monance.—Houses (58), Station Road (£25,000); burgh surveyor, Town House, St. Monance.

Sale.—Houses (200), Beech Farm estate; borough surveyor, Town Hall.

Scarborough.—Additions to the Queen's Hotel; Wilkinson and Smith, architects, 6, Queen Street.

Sheffield.—Cinema, Eastern Avenue, for the Sheffield and District Cinematograph Theatres, Ltd. (£35,000). Maternity block (£150,000), Jessop Hospital for Women, with electrical work.

Shipley.—Houses (20), Gaisby Lane; A. Greenwood. Extensions to Saltaire mills, Victoria Road; Salts (Saltaire), Ltd.

Southport.—Blocks of flats, Alexandra Road; F. Haslam. School, Meols Cop (£26,024); A. Jackaman & Son, Ltd. Enlargement to Birkdale and Farnborough schools; L. Barnish, architect.

South Shields.—Cinema, Ocean Road, for Tatlers Theatres, Ltd., and shops and flats, Marsden Road, for J. Wilson; J. H. Morton and Sons, Martins Bank Chambers, Fowler Street. Extensions to Town Hall (£16,000); borough engineer.

Stafford.—Houses (26), Stone Road and South Walls; borough surveyor.

Stokesley.—Houses (22); R.D.C. surveyor.

Stretford.—Houses (206), Barton Road estate; borough engineer. Extensions to Gorse Hill school (£14,354); C. Musker Bros., Ltd.

Sunderland.—Clinic, in the east end; borough engineer.

Surrey.—Schools, Ewell, Purley, and extensions to County Boys' school, Mitcham, for County E.C. Extensions to County hospital, Dorking (£35,314); county architect.

Torquay.—Development of Rockend estate; Bridgman & Bridgman, architects. Alterations to Hotel Regina; Hotel Regina, Ltd.

Uxbridge (MIDDLESEX).—Cinema, High Street, for the Odeon Theatres, Ltd.; A. Mather, architect, Leicester Square Chambers, London, W.C.2.

Wakefield.—Houses (100); housing architect, Town Hall.

Wallsend-on-Tyne.—Houses (60) in flats; R. A. Gofton & Sons, Front Street, Monkseaton, Whitley Bay. Cinema, High Street (£50,000); T. H. Pailor, Hippodrome, West Hartlepool.

Warlingham.—Development of Sunnyside estate, Hillbury Road; R. J. Clarke & Co.

Warrington.—Houses, Eastford Road; W. Berry. Extensions to works, Bank Quay; British Aluminium Co., Ltd. Extensions to works, School Brow; Rylands Bros., Ltd.

Washington.—Houses (60), near the Drive, Heworth Road; L. T. Brooms, architect, Council Offices.

Watford.—Shops and offices, St. Albans Road; Marsham Tyre Co. Extensions to factory, Bushey Mill Lane; Blaw-Knox, Ltd. Extensions to works, Tolpits Lane; Scammell Lorries, Ltd. Houses (120), Leavesden Green (£44,248); J. W. Jones, Weybridge.

Wednesbury.—Houses (24), Hydes Road, Paul Street; S. Hallard & Co., builders, Smethwick.

Weldon (NORTHAMPTONSHIRE).—Houses (22), Weldon Road; T. Bennett.

Welshpool.—Houses (100), Bronkybuckley; W. Sherratt, builder, Beaumont Road, Church Stretton.

Wolverhampton.—Additions to the Infectious Diseases Hospital (£56,710) with electrical work; H. B. Robinson, surveyor, Council House.

Worthing.—Houses (22), near Warren Road; L. C. McMaitre. Flats (42), Norfolk Street; F. W. Beach. Flats (60), South Farm Road; Centrecourt Investment Co. Shops and flats, Ham Road; East Worthing Properties, Ltd.

Yorkshire.—Extensions and new gymnasium, Cudworth Senior council school, for West Riding C.C.; education officer, County Hall, Wakefield.